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POWER PLANTS FOR RELAY SWITCHBOARDS.

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Since the first introduction of the battery telephone there has been constant effort on the part of inventors to centralize all the batteries used for talking. Many schemes were evolved for this purpose, as reference to the Patent Office records will clearly show. The general practice, however, up to about the middle of the last decade, was to use local transmitter batteries and magneto calling apparatus. Along about 1895 the common battery board commenced to be generally used in practice. It is really returning to the first principles of telephony; that is, a battery cell and centralized batteries for transmitters.

The successful introduction of the common battery system is undoubtedly due to the perfection of the storage battery and the perfection of machines for charging the same. It is a fact well known that in order to supply a number of transmitters from one battery without having cross talk, that battery must have the lowest possible internal resistance, and the perfected storage battery possesses this feature of extremely low internal resistance. In the common battery system as used to-day current is supplied to the subscriber's transmitters, to the operator's transmitters, to all the different relays and lamps, from one centralized storage battery.

The first common battery systems were equipped on the multivolt plan, that is, 20 volts for operating subscribers' transmitters, 8 volts for operating relays and lamps and 4 volts for operators' transmitters and lamps. In the last year or two the apparatus has been so perfected and arranged as to allow the use of but a single set of batteries operating at 24 volts. Not even a duplicate set of batteries is required, for, because of the peculiar construction of the charging dynamos and the insertion of choke coils in the charging circuits, it is possible to charge and discharge the batteries at the same time without making the lines noisy.

On account of the inability to manufacture lamps which would operate satisfactorily on a potential varying from 22 to 28 volts, it was necessary until recently to resort to the use of an end cell which could be switched in or out at will. Recent improvements in lamp manufacturing have permitted the disuse of the end cell, for lamps are now made which will operate satisfactorily on a potential varying from 22 to 28 volts.

As brought out above, the vital point in common battery transmission is the low resistance of the batteries. If this were not the case cross talk would be produced on all lines because of the variation of the potential difference over the terminals of the battery. The Hayes system of split repeating coils is used now almost universally with the common battery system.

Since the batteries are the very soul of the relay telephone exchange every possible precaution must be taken to provide them with charging current at all times. Therefore, in designing a power plant for a relay system the question of power supply should receive careful study and that power selected which is, first, most reliable, and, second, most economical.

PRIMARY SOURCES OF POWER.

The primary sources of power usually obtainable may be classed as follows:

(1) Electricity—
110, 220, or 500 volts direct current.
104 volts, single phase, 133 cycle, alternating current.
104 volts, single phase, 60 cycle, alternating current.
204 volts, two phase, 60 cycle, alternating current.
204 volts, three-phase, 60 cycle, alternating current.

(2) Gas—
Illuminating gas.
Producer gas.
Gasoline.
Kerosene.
Natural gas.

(3) Water—
Wheels of the jet type, such as the Pelton, American Impulse and Leffel Cascade can be used where the water pressure exceeds fifty (50) pounds to the square inch.

(4) Steam—
Any ordinary form of steam engine with an automatic shaft governor.

The most desirable electric power for operating motors connected to charging machines is a 220-volt direct current circuit, which has but a slight voltage fluctuation. Five hundred-volt circuits are used in a great many cities for power purposes and are generally reliable. This power should not be used if street cars are run off the same circuit, or if the dynamos operating street cars are run off the same countershaft as the machines used for generating the 500-volt power current. If direct current cannot be obtained a single phase, two phase or three phase alternating circuit should be used. Motors are now manufactured which operate satisfactorily on any of these phases and also at a high efficiency. But one source of power should be used from one electric station, for, obviously in case of fire all circuits would be out. As two sources of power should be available for charging purposes a gas or steam engine must be used, if it is not possible to obtain two sources of electric power from two different stations.

Next to electric power, power obtained from a gas engine is most desirable. If gas is not available, gasoline can be used. Engines are also manufactured which use kerosene for fuel, but have not come into practice for charging machines in telephone exchanges. Water motors might be used for charging purposes where a sufficiently low rate can be obtained and where the water pressure is steady. Wheels of this kind should be so designed that the peripheral speed of the buckets equals one-half of the velocity of the impinging jet to obtain maximum efficiency. When in use the belting should be so arranged as to procure this condition. Steam engines are ordinarily not used for the running of charging dynamos direct, but are usually connected to an engine supplying lights and power for an

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exchange building and the charging motors are run from these power mains.

For the proper handling of the various circuits the power switchboards are generally divided into motor panels, generator panels and fuse panels.

In addition to the regular volt meters and ammeters I think that the switchboard should be provided with watt meters in the motor circuit and in the charging and discharging circuits. It would then be possible, at all times, to know the exact efficiency of the power plant and to immediately remedy any defects. The very best apparatus obtainable is none too good for the power plant of a modern relay telephone switchboard.

The storage battery claims such a vital part in the operation of the common battery system that I think it advisable to make a few remarks upon its theoretical operation, and incidentally to give the results of some personal experiments.

The storage battery consists of a number of lead plates in a dilute solution of sulphuric acid, H_2SO_4. Half of these plates are joined together and called positive plates and the other half are joined together and called negative plates. When a storage battery is fully charged there is on the surface of the positive plate a thick coating of lead peroxide, PbO_2, and the surface of the negative plate is converted into a spongy lead, Pb. During the discharge both electrodes are converted into lead sulphate, $PbSO_4$, by the extraction of sulphion from the electrolyte, thus reducing the density of the solution. The chemical reaction may be represented by the following equations:

$PbO_2, H_2SO_4, Pb SO_4, H_2, O, O,$

$Pb O H_2, SO_4, Pb SO_4, H_2, O,$

or, putting both equations together,

$PbO_2, H_2SO_4, Pb, Pb, SO_4, 2H_2, O, Pb, SO_4.$

The recharging of a cell is practically the transference of oxygen from the negative plate to the positive plate. In discharging, the action of the positive plate is supposed to take place in two stages: 1st, reduction of the peroxide to monoxide, and then the conversion of the monoxide to lead sulphate. On charging the action is reversed, the sulphate being converted into peroxide on the positive plate. The point might be brought up that there would be local action between the lead peroxide on the positive plate and the supporting lead grid on the plate itself. Such action does undoubtedly take place, but a thin layer of lead sulphate will form between the lead peroxide and the lead plate which, because of its insolubility and relatively high resistance, prevents further local action.

It has been observed that the voltage of a cell when charging is always higher than on discharging, even when full allowance is made for the voltage drop, due to the internal resistance of the cell. This shows conclusively that the chemical reactions of the charge are not the reverse of those on discharge; for if they were the voltage on charge and discharge would be equal.

Another point which has been observed is that the internal resistance of a storage battery is some function of the current. When the rate of discharge is high, the internal resistance of the cell is low and vice versa. Consequently it would naturally be expected that as the amount of current drawn from the storage battery decreases that the voltage would drop, due to the fall of potential over the increased resistance of the battery. Such, however, is not the case, as I chanced to discover in an efficiency test on the Dallas plant. As the rate of discharge became less the voltage rose, which proves conclusively that the voltage is also some function of the discharging current and is independent of the internal resistance. This will be described more in detail under the head of "Efficiency Test."

In charging storage batteries, the current at the beginning of the charge should not be too great or considerable energy will be lost, due to the internal resistance of the cell, which is highest when in a discharged state, as the acid is then out of the solution and in the plates. Too low a charging current is also detrimental, for it tends to produce a layer of white sulphate over the plates, which completely resists further electrolytic action and lowers the capacity of the cell. Generally speaking a cell should never be charged at less than one-tenth (1-10) of its normal rate. Buckling is generally due to too high a charging current and too high discharging current, which makes the plates expand unevenly.

Lately experiments have been made in the use of rectified alternating current for charging storage batteries, and with gratifying results. It seems that the peculiar character of the current hastens electrolytic action.

As explained later under the head of "Instructions," a cell should never be allowed to discharge below 1.8 volts. The reasons for this are as follows: First. The regulation is troublesome. Second. Efficiency is low. Third. Dangerous molecular changes take place in the interior of the cell. Fourth. Plates with uneven amounts of charge discharge into one another. Fifth. Life of the battery is considerably shortened. If the voltage of any one cell in a series is allowed to fall to 0, which might be caused by a short circuit, and the other cells continue to be discharged, the exhausted cell will reverse its polarity. This is because it is charged in a reverse direction by the current from the other cells and the positive plates become negative, and vice versa.

It has been attempted to use some other material than lead for storage batteries, but lead alone of all the metals forms a sulphate which is insoluble in sulphuric acid and unacted upon to any extent. This sulphate between the active material and the grid almost entirely prevents local action and the consequent rapid destruction of the cell. Claims of an efficiency of eighty (80) to ninety (90) per cent have been made for storage batteries, but it is probable that the average commercial efficiency does not exceed seventy-five (75) per cent.

The losses in the cell may be classed as follows: First. Direct losses due to heat. Second. Losses due to local action between supporting grid and active material itself. Fourth. Losses due to unreserved chemical action; that is, the production of hydrogen, oxygen, ozone and hydrogen peroxide. The last two losses are the most serious.

When a battery is to stand for any length of time it should be fully charged and not discharged any. When the cell is fully charged there is a film of peroxide over the entire positive plate, which thus prevents local action between the active material and the lead supporting plate. If the cell should be discharged slightly this film of peroxide on the lead supporting grid would be destroyed and there would be a chance for local action between this lead grid and the active material.

Some very interesting phenomena were observed in relation to the voltage between the different elements and the lead linings of the cells. These experiments were conducted upon the main battery at the Dallas exchange. The following are some of the results:

The voltage between the lead linings of the different cells is equal to the voltage of the cells. The voltage between the positive plate and the lead lining is, when fully charged, 1.4 volts positive. When the cell is discharged down to two volts, potential is 1.35 volts positive. Voltage between the negative plate and the lead linings is .7 volt negative and .65 volt negative respectively when the cell is fully charged and discharged to two volts. Thus the sum of the voltage between the elements and the lead lining is always, under normal conditions, equal to the voltage of the cell. This is probably due to deformation of some of the higher forms of sulphate on the lead lining. It is curious to note in this respect that 1.4 volts is the difference of potential required to decompose water. The voltage between the ground and the lead lining of the first cell is 1.4 positive and 2 volts to 2, to 2.1 volts is added for each additional lining. Thus the voltage between the ground and the lining of cell No. 3 would be, under nor-

mal conditions, 5.5. If now we ground the lining of the cell through a low resistance a heavy current would flow. Large amounts of hydrogen and oxygen gas are generated and a strong odor of sulphur is noticed.

Supposing that the No. 3 cell was grounded and its voltage to earth initially was 5.5 volts. Immediately after the above current has passed it will be noticed that the voltage has fallen to 4.1. This is explained on the supposition that the highest sulphate lead on the lead lining is electrolized into a film of peroxide of lead and is therefore at the same potential as the positive plate in the No. 3 cell, or, in other words, it is equal to the voltage of the two cells. If the voltage between the positive plates and the lining is now measured it will be found to have fallen to 0, and the voltage between the lead lining and the negative plate is 2.1 volts positive.

An important result is drawn from the above experiment. If the lining of a cell, or the wood casing, which is damp, becomes grounded, current will flow and in a short time the lead lining will be eaten up by electrolysis, or in other words the lining will be rotted into lead peroxide.

Above it was shown that the cell in normal condition measured 1.4 volts positive between the positive plate and the lead lining and .7 of a volt negative between the lead lining and the negative plate. Therefore, if a cell is grounded, the voltage between the positive plate and the lead lining will be considerably less than 1.4, and between the lining and the negative plate more than .7 volts, depending upon the rate of action. This will be true even though the lead lining is grounded through a high resistance, as was conclusively shown by experiments.

The above makes an accurate test for a grounded cell and care should be taken to remove ground on the lining at once or the lining will be destroyed.

After grounding, the recovery of the lining takes place quite rapidly, as shown by the following table. There seems to be a point where the film of peroxide is suddenly broken and the recovery is extremely rapid after which the recovery is slow.

CELL NO. 5.

Lining grounded for 20 seconds,
Approximately 25 amperes of current flowing.
Voltage of lining to ground before grounding lining 9.5 negative.

Time.	Volts.	Time.	Volts.	Time.	Volts.
0.	8.1	45.	9.4	45.	9.42
15.	8.225	2. min.	9.4	4. min.	9.42
30.	8.25	15.	9.4	15.	9.42
45.	8.4	30.	9.4	30.	9.425
1. min.	9.2	45.	9.4	45.	9.425
15.	9.3	13. min.	9.4	5. min.	9.425
30.	9.35	15.	9.41	6. min.	9.425
		30.	9.41		

If the linings of two or more cells become crossed through a high or low resistance, current will flow from lining of higher potential to the lining of lower potential, and, consequently will cause trouble to the lining having the lower potential, since current will flow from lining into the solution, which is an ideal case for electrolysis. The voltage readings of the cell of lower potential will show up exactly as though the cell were grounded. The voltage of the lining of the higher cell changes, however, in exactly the reverse manner. The voltage of the positive plate to the lead lining is now 2.1 volts positive and the voltage of the negative plate to the lead lining is 0. This shows that the current passing to the lining broke up the high sulphates and changed them into spongy lead, or, in other words, made a negative plate out of the lining.

By taking the above readings occasionally it can readily be determined whether the linings of a cell is crossed or grounded with the lining of any other cell. I think that there should be a pair of wires running from the voltmeter switch into the storage battery room and ending on terminals. By attaching wires to these terminals and throwing switch in a proper position at the voltmeter it will be possible to take all the above readings with the regular station instrument. It would be well to take these readings about twice a month.

Below is a test of a cell whose lining was crossed with the lining of a cell of lower potential:

CELL NO. 4.

Lining crossed with lining of cell No. 6 for 30 seconds.
Approximately 20 amperes of current flowing.
Voltage of lining of cell No. 3 to earth before test 7.5 negative.

Time.	Volts.	Time.	Volts.
0.	8.5	30.	8.2
15.	8.2	45.	8.2
30.	8.2	4. min.	8.2
45.	8.2	5. "	8.2
1. min.	8.2	6. "	8.1
15.	8.2	7. "	8.1
30.	8.2	8. "	8.05
45.	8.2	9. "	8.05
2. min.	8.2	10. "	8.05
15.	8.2	11. "	8.03
30.	8.2	12 "	8.03
45.	8.2	13. "	8.03
3.	8.2	15. "	8.2

After 2½ hours 7.8.

It will be noticed from the above that after the lining is once changed into spongy lead that it has difficulty in again assuming the higher sulphate form. This is exactly the reverse of when the plate is converted into lead peroxide, as shown in the first table.

Lack of time prevented me from pursuing these investigations further, but there are undoubtedly many curious battery phenomena yet to be discovered, many of which will have a practical value.

Above it was mentioned that the internal resistance of the storage battery was some function of the current, and it is also mentioned that during a test on the Dallas cell it was discovered that the voltage is also some function of the current.

In laying out the arrangements for the efficiency test it was considered that the cells could be taken through a complete cycle of charge and discharged by bringing them back to the same voltage, and the test was started under this assumption. During the time when the board was busiest a considerable amount of current was drawn from the batteries. The voltage fell steadily, but as the load upon the switchboard decreased it was noticed that the voltage again began to rise, although the cells were now in a partially exhausted state. Fortunately specific gravity readings were taken at intervals and the efficiency test was stopped when the average specific gravity equaled the average specific gravity before beginning the charge. This shows conclusively that the voltmeter reading does not show the exact condition of a cell and should never be entirely relied upon. Specific gravity readings should always be taken.

EFFICIENCY TEST OF POWER PLANT.

In order to determine the exact condition under which the ordinary storage battery plant for telephone exchanges operates in practice, a complete efficiency test was made on the Dallas power plant. This test was started at 10 a. m. in the morning and was continued until 4.55 p. m. The power plant consists of two type G-3 Western Electric motor generators. The motors are designed to run on 220 volts at 1,150 revolutions. The generator gives from 24 to 30 volts and 100 amperes. The batteries are type G-11, chloride accumulators. There are eleven (11) cells with plates lead burned together and are set up in wooden tanks with lead linings. The elements are supported on plate glass strips and separated by glass rods. This plant has

been in continuous operation since February 8, 1899, and the batteries and generators are still in very fair condition, although some trouble has been experienced with several of the cells. A powdery deposit formed at the top of the positive plates. It was of a reddish-brown color and when subjected to a chemical analysis showed an excessive amount of iron.

Before starting the main test the amperes and volts in the motor were taken with no load on the generator and the fields unexcited. In making the test the following readings were taken every two and a half minutes: Volts and amperes in the motor circuit; volts and amperes delivered by the dynamo; volts and amperes in the discharging circuit, and during discharge current delivered to coil rack.

From the above readings it was possible to determine exactly how much energy was lost in the motor, how much in the dynamo, how much in the charging mains, how much was delivered to the switchboard and how much was delivered to the batteries.

During the time of discharging the volts and amperes were read as well as the amperes taken by the coil rack. The test started at 10 a. m. and the batteries were charged for three (3) hours, or until 1 p. m. From 1 p. m. to 4:45 p. m. the batteries were discharged.

In laying out the test it was thought that by allowing the batteries to discharge to a certain voltage, then charging them and allowing them to go back to the same voltage, that a complete energy cycle would be accomplished. This proved, however, not to be the case. As explained under the head of "Theory of Batteries" the internal resistance of a storage battery decreases with the current, and that when a light load is taken from the batteries it would be expected that the internal resistance is greater and consequently the drop over batteries would be greater as the load fell off from the batteries. In the afternoon it was noticed that the voltage did not continue to fall, but about 6 o'clock it commenced to rise. This proves conclusively that the voltage of a cell is not a direct function of the state of charge, but is some complicated function of the rate of discharge. Voltmeter readings are, therefore, never to be entirely relied upon to ascertain the condition of a cell. Fortunately in the above test specific gravity readings were taken at short intervals, and the test, so far as the efficiency was concerned, was stopped when the average specific gravity at the end of discharge was the same as the average specific gravity just before charging. The specific gravity is the only true means of finding out the condition of charge in a cell.

The general results of the test are as follows:

Watt hours delivered to motor	10,476
Watt hours required by motor generator to overcome friction	2,013
Watt hours delivered to charging circuit	7,066
Watt hours lost in charging circuit	411
Watt hours delivered at battery terminals	6,655
Watt hours delivered to switchboard	2,542
Watt hours delivered to batteries	4,113
Watt hours delivered by batteries	2,978
Efficiency of motor-generator combination	67.5
Efficiency of motor-generator and battery leads	63.5
Efficiency of charging mains	94.3
Efficiency of batteries	72.4
Efficiency of batteries in combination with motor-generator and leads	46.
Percentage of total energy delivered to batteries	39.2
Percentage of total energy delivered to switchboards	52.6
Percentage of total energy lost in friction and excitation of motor	19.2
Plant is run six (6) hours per day at an efficiency of	63.5
Plant is run eighteen (18) hours per day at an efficiency of	46.
The ringing machines take an average of about	150 wts.

The motor-generator shows a maximum efficiency when operating between ninety (90) and one hundred and ten (110) amperes. Below is a table which shows the efficiency of the motor-generator at different loads:

Generator			Motor			
Volts.	Amperes.	Watts.	Volts.	Amperes.	Watts.	% Eff.
23.75	20	475	220	5.	1,100	43.
23.75	30	712	220	6.25	1,175	51.8
24.25	40	970	220	7.5	1,650	58.8
24.5	50	1,225	220	9.	1,980	61.9
25.	60	1,500	216	10.5	2,268	66.1
25.5	70	1,585	214	12.5	2,675	66.7
25.75	80	2,060	214	14.25	3,050	67.5
26.5	90	2,385	211	16.25	3,428	69.6
27.	100	2,775	209	18.75	3,918	70.8
27.75	110	3,052	228	19.5	4,446	68.7
28.25	120	3,390	226	22.	4,972	67.9
28.5	130	3,705	224	24.5	5,488	67.3
26.5	140	3,715	223	25.	5,575	66.6
26.75	150	4,012	220	28.	6,160	65.1
27.	160	4,320	218	30.5	6,650	64.9

A little consideration will show us that it is highly desirable to run the charging machines as much as possible. When the charging machines run a certain amount of energy is delivered to the batteries and the remainder is delivered to the switchboard. It is clear that the energy delivered to the switchboard is delivered under this condition at an efficiency of 63.5 per cent, which is the efficiency of the motor-generator in combination with the battery leads. When the storage batteries are used to furnish energy to the switchboard, it is furnished at an efficiency of but 46 per cent, which is the efficiency of the storage batteries in combination with the motor-generator and charging mains. During the complete time in which this test was made energy was supplied to the switchboard for three hours at an efficiency of 63.5 per cent, and for four hours at an efficiency of 46 per cent. The ratio of the sum of the energy delivered by the batteries and the dynamo to the switchboard to the total energy supplied is obviously the station efficiency of the plant; or, in this test, 52.6 per cent.

From the above it is clear that we should run the charging machine whenever the load to the board is such that the efficiency of this machine will be over 46 per cent. This will probably require the charging of the storage batteries at lower than the normal rate, but this is highly desirable, for the reason that less energy will be wasted, for it is well known that the slower the rate of charge on a storage battery the higher will be its efficiency. This charging, however, should not be less than one-quarter the normal rate, so as to prevent any chance of sulphating. In any storage battery plant of a telephone exchange where the cost of current for power is important, a little experimenting along these lines will enable the plant to be run at a high efficiency and a considerable saving effected.

In considering the general results of this test attention is called to the not very high efficiency of the motor generator. The loss in the charging mains is an item that appears to be too high; 72.4 per cent is not a high efficiency for a storage battery and it seems reasonable to expect at least an efficiency of 80 per cent in commercial practice. In looking over the curves it will be noticed that the first four curves, "a," "b," "c" and "d," correspond quite closely in form, but that curve "e," while preserving the same general shape, does not correspond exactly. This is due to the fact that the current taken by the switchboard varied continuously, and consequently caused a variation in the amount that the batteries received, as practically they were in a divided circuit and it was not possible to keep the voltage exactly constant. In the discharging curve, attention is called to the fact that only about one-third of the total energy delivered to the switchboard is used for the current supplied to the subscribers' transmitters, the remainder being used in signals on the switchboards.

All the measurements in this test were made with the

"Weston" instruments and it is quite probable that the test is fairly accurate. In my opinion, a test of this kind should be made on every storage battery plant at periods not greater than six months, for, if anything is wrong with any part of the plant, it can be quickly discovered and remedied at once.

INSTRUCTIONS FOR THE CARE OF POWER PLANTS.

1. The ordinary telephone exchange power plant is equipped with two charging dynamos, one of which is usually run by an electric motor and the other by a gas engine. The motors are usually shunt wound machines and operate on 110 to 500 volts. Sometimes single-phase, two-phase or three-phase motors are used. Charging machines are shunt wound, but are sometimes provided with a series coil arranged to be more or less short circuited with a German silver shunt. The charging machines are constructed with a large number of commutator bars and are so designated as to produce a minimum fluctuation in the charging current. The motor panel on the switchboard is generally equipped with a starting switch and a starting rheostat for the motor. The dynamo panel is equipped with switches for charging the batteries, and these are sometimes supplemented with what are called end cell switches. There is also provided a rheostat for cutting in or out resistance in the dynamo fields so as to be able to vary the voltage. The circuit breaker in combination with the polarized relay is also provided which opens the dynamo circuit whenever the load drops below or goes above certain fixed limits. Necessary switches are also provided for the small ringing dynamotors and for the B. B. and D. A. tests.

2. It is highly important that the brushes on the dynamo be kept in perfect condition, and well trimmed; otherwise the dynamo will throw noise upon the lines during charging.

3. Great care should be taken to keep the dynamo and motor carefully cleaned. Constant inspection will readily reveal any defects, and they should be remedied before serious trouble ensues.

4. The switches on the switchboard should be kept dry and clean, so as to insure positive contacts. The fuses must also be screwed in tightly, for if they are in a talking circuit it will throw noise on the lines. An instance of this kind happened in the Dallas exchange; the main fuse going to the coil rack became slightly loose and the entire exchange became so extremely noisy that it was almost impossible to give service.

5. In starting the motor generator, after seeing that all the machinery is in perfect condition, the starting switch for the motor should be thrown in, then the controlling rheostat in the motor circuit should gradually be turned until the motor is brought up to speed, and the rheostat will then be entirely cut out. Now throw in the main dynamo switch, which throws the dynamo directly on to the charging mains, but leave the circuit breaker thrown out. The dynamo must now be brought slightly above the voltage batteries by means of the rheostat in the field circuit. When the voltage of the dynamo is two or three volts above the voltage of the batteries, the circuit breaker must be suddenly thrown in and the machine will start to carry the load. The load can then be regulated to any desired output by means of the rheostat in the dynamo field circuit. . In order to stop charging, the rheostat in the dynamo field circuit must be turned so as to decrease the voltage of the dynamo. This will cause the load to fall off rapidly until the limit of the circuit breaker is reached, which will, of course, be thrown. Keep turning rheostat until voltage of generator gets very low. Now pull the dynamo switch and the motor switch in succession and the machine will be shut down. If the power should go off the motor circuit and the circuit breaker should fail to work, a current will be sent in the reverse direction through the dynamo. This will reverse the fields, and when it is tried to charge again it will be noticed that the voltage is in the reverse direction. This can be remedied by taking a pair of wires from the storage battery and sending a current through the fields in the proper direction.

1. When a battery has been set up and properly connected in series and all the connections with the switchboard properly made, the acid may be put into the cells. The plates should never be left exposed to the air for any great length of time, as they will deteriorate. The acid, when put into the cells, should have a specific gravity of 1,180 to 1,190 degrees. The charge should then be at once commenced at about half the normal rate. After charging at this rate for a short time, if it is determined that all connections are well made, the rate should be increased to the normal and continued for about twenty consecutive hours, or until the potential of each cell reaches 2½ volts and all the cells are gasing freely from both negative and positive plates. The specific gravity of the electrolyte, which fell shortly after the cells were filled, should now reach at least 1,200 degrees. At this point the charging rate should be reduced to one-half the normal rate and the charge continued until the electromotive force of each cell has again reached 2½ volts. The regular service of the battery may now be commenced. On the subsequent charges, to the number of five, the cell should be brought up to 2 6-10 volts per cell at the normal rate, or, preferably, 2½ volts at half the normal rate.

2. In ordinary use the batteries should never be discharged below 1.8 volts per cell. When the battery is discharged it should not be allowed to stand in that condition, but should be immediately fully charged. Ordinarily the battery should never be charged beyond a voltage of 2½ per cell. Care should be taken, however, to reach this figure, and if there is any considerable drop in the voltage between the battery and the switchboard it must be allowed for. About once a week it is advisable to continue the charge beyond this point at half the normal rate until the voltage of 2½ per cell has again been attained. This charge should ordinarily exceed the discharge in ampere hours about 10 per cent. Even when for any reason the battery is only slightly used it should, notwithstanding, be charged fully about once in two weeks.

3. Voltage is not the only indication of the condition of charge of a cell; a fully charged cell will gas or boil violently when charging at the normal rate. Any continued lack of charging will make itself visible in the color of the plates. The positive plate should have a dark brown velvety appearance. Any lightness in color indicates insufficient charging. No attention should be paid to the whitish precipitate that sometimes appears on the positive plates. The negative should have a clear bluish lead or light slate color.

4. Lack of charging, if continued long enough, will result in the formation of white sulphate on the plates. Its presence is indicated by white patches on the negative plates and is the cause of loss of capacity and of higher voltage than the state of charge of the cell would ordinarily show. If lack of charge has been carried so far as to cause the appearance of this sulphate, no time should be lost in getting rid of it, which can usually be accomplished by continued charging at half or lower rate after the cells are gasing violently, as if fully charged. The most reliable indication of the state of charge of a cell is the specific gravity. This rises during charge, but if at the end of charge it has not attained a proper value, it is an indication of insufficient charge, even if the other indications of complete charge high voltage and violent boiling are present. It is important in this connection not to draw a wrong conclusion from low density due to the recent addition of water to the cell. This change is a relative one. The specific gravity of the electrolyte should be 1,205 degrees when the cell is fully charged, but during discharge it should fall to about 1,195 degrees.

5. Distilled water or fresh cistern water must be added to the electrolyte to make up for the loss by evaporation. This water should not be added in large quantities to reduce the specific gravity to any considerable extent; it should be added before charge at the bottom of the cell through a rub-

ber hose connected to a large syringe. The syringe should be filled partly with water and partly with air, and the mass of liquid and air discharged at the bottom of the cell. This insures thorough mixing. The plates should always be covered by the electrolyte to the depth of at least one-half of an inch.

6. During charge, some of the acid in the solution may be lost by the spraying, which occurs during the latter part of the charge. By the violent evolution of gases at that time small particles of the dilute acid are thrown upwards and are prevented by air currents in the room from falling back into the cells. If this is replaced by water in the regular filling up of the cells, the specific gravity may be lowered from this cause. Therefore, it is occasionally necessary to add a dilute solution of sulphuric acid to the cells. This should be made by mixing pure sulphuric acid and water until a density of 1,400 degrees is obtained; that is, put one part of sulphuric acid to one part of water, by volume. The acid should always be poured into the water and not the water into the acid, as a dangerous heat would be developed. This solution should not be added to the cells until it is thoroughly cool.

7. The principal form of trouble that is likely to occur in a cell is a short circuit, complete or partial, between the positive and negative plates. This will be indicated by low voltage and low specific gravity and should be at once removed. Its most probable cause is the lodging between the plates of some foreign article or a loosened part of the plates themselves. Sometimes a piece of rubber insulation will so lodge between the plates that the scales falling off the plate will lodge upon this piece of insulation and will eventually cause a partial short circuit between the plates. It may also be due to the depth of sediment in the bottom of the cells reaching the bottom of the plates. If the short circuit is due to a foreign body, is should be removed; if to a loosened portion of the plates, it may be forced to the bottom of the cell; if to sediment, the cells should be cleaned out. A strip of hard rubber that will go between the plates is convenient for use in this work. An ordinary switchboard lamp connected to the main battery and mounted upon the end of a rubber rod is of great assistance in inspecting batteries. The connections should be thoroughly taped with rubber tape to prevent short circuiting the cell. It can be lowered between the plates and any imperfection readily discovered.

8. When the cell has suffered a short circuit, it will generally be necessary to give it more than the usual amount of charge. This can be done in several ways: First. By overcharging the whole battery. Second. By giving the cell in trouble an extra charge during the discharge of the battery. This can best be obtained by using the regular charging generator with a water rheostat cut in series with the bad cell. Care should be taken not to carry this to excess.

9. If the battery is provided with end cells, note should be taken of the fact that these cells are not discharged to the same extent as those in the main battery, and consequently, they must be cut out on charge as they come up. Neglect of this precaution will result in the loss of power and harm to the end cells from the excessive charging.

10. Great care must be taken that none of the lead linings of the cells are grounded, even through a high resistance, for, as explained above under the head of "Theory of Batteries," if this is the case the lead linings will quickly be rotted into peroxide of lead, and a leaky cell in a telephone exchange is as dangerous as low water in a boiler of an electric light plant. A quick test for discovering whether the lead lining of a cell is grounded is given under the head of "Theory of Batteries."

11. If one cell in a series suffers a short circuit it will soon discharge until its potential is 0. If the other cells in the series still continue to be discharged, this short circuited cell will be charged in a reverse direction and its polarity will be reversed. No time should be lost in giving this cell an extra charge. This charge should be started very gently at first, as the cell is in a very weakened condition and has but little counter-electromotive force.

12. In the larger sized batteries, the lead plates are supported upon glass strips. These strips being above the surface of the solution, become coated with a layer of acid, dust, carbon, etc., and become in a short time very fair conductors. These glass strips should be wiped clean very frequently. A test on the plates in the Dallas exchange, with the solution all out of the cell, showed an insulation resistance of only 400 ohms between plates and lead lining. Hence, the extreme necessity of keeping the plates highly insulated from one another.

13. If for any reason the entire series of cells become so bad that it is impossible to use them, they should immediately be cut out, and the entire switchboard load carried direct from the generator. It has previously been thought that the proper way to make the generator carry the load was to bridge a large number of condensers across the terminals of the charging dynamo.

In experimental work in the Dallas exchange it was found that the quiet operation of the switchboard from the dynamo did not depend at all upon the condensers, but rather upon the load that the generator was carrying.

In our experiments we at first tried to run the switchboard direct from the machine with fifty, 2 M. F. condensers cut across the terminals. The cells were cut out by taking the contact pieces off from each end of the end cell switch. The noise on the board was terrific and of a very pulsating nature. It was decided that the machine should be made to carry some non-inductive load in addition to the switchboard load. Therefore, a water rheostat consisting of two Fuller carbon plates, immersed in a solution of brine and set in a ten-gallon crock, was set up.

When there were about eighty amperes flowing through the rheostat, and the batteries were cut off, the condensers still being cut across the machine, the noise on the switchboard was not objectionable, and, if absolutely necessary, the exchange could have even run a day or two without serious complaint.

For the sake of experiment, the condensers were now cut off entirely and the discovery was made that it didn't make any difference in the noise on the switchboard whether the condensers were on or off; if anything, the board was quieter with the condensers off. It seems that the non-inductive load absorbed the current fluctuations of the machine.

Consequently, if a battery in a relay exchange should suddenly break down, through the leaking of a cell, for instance, all that it would be necessary to do would be to bridge a non-inductive water resistance across the terminals of the battery. The electrolyte can now be taken completely out of the bad cell and the plates of the water rheostat adjusted so that the load on the machine is about the average charging load of the batteries. When the bad cell is repaired the electrolyte can be poured in slowly and the plates in the water rheostat gradually adjusted until most of the load is on the cells again. The plates in the rheostat can now be pulled out altogether.

This makes a very easy way to run the switchboard from the dynamos and I think that all relay exchanges should have a water rheostat handy.

14. If for any reason a storage battery is to stand for several days without being used, care should be taken to give it a complete charge, and, after being charged completely, it should not be discharged at all. When completely charged, the thin film of lead peroxide on the supporting grid of the positive plate prevents local action. If the cell is discharged slightly, this film is destroyed and local action will take place in the cell more rapidly.

15. To take a battery out of service it should first be given a full charge. The acid should then be syphoned off and put into convenient receptacles, preferably thoroughly clean carbons. This acid may be used again. Fill each cell with pure distilled or rain water as soon as it is empty.

When all are full of water discharge the battery at the normal rate down to less than one volt per cell. Remove the elements from the water and allow them to dry. In putting them into commission again, the same plan should be followed as described for "Setting Up a New Battery." If the cells are packed up, keep the plates separated with sheets of paper and bind the elements thoroughly together.

16. Great care must be taken in procuring water for the storage battery solution, that it be entirely free from all impurities, such as iron, arsenic, nitric or hydrochloric acid. If any of these elements are present in the solution the cells will rapidly deteriorate.

(Note.—The majority of the above instructions are taken from the "Standard Instructions" of the Electric Storage Battery Company.)

For records to be kept by the attendants at storage battery exchanges I have prepared the following tables: The voltage at the beginning and end of charge of each individual cell should be taken each day. The total voltage at the end of charge should also be taken, as this will give a chance to check up the individual readings of the cells. The approximate rate of charging, and the number of hours charging, should also be taken. Every second or third day the specific gravity at the beginning of the charge and the specific gravity at the end of charge should be taken of each individual cell. In addition to the regular daily report, I have prepared a report which should be taken on the 10th of every month, or on same days the peg count of the exchange is taken. This report will show the highest rate of discharge and the lowest rate of discharge; the average rate of discharge and the average rate of charge, and the voltage and specific gravity at the beginning and end of charge of the individual cells. This, plotted in conjunction with the peg count curve, will show exactly the work that the batteries are doing.

BRITISH TELEPHONE NEWS.

(From our London Correspondent.)

One of our engineering periodicals recently asked the question of why the government did not, when proposals were first made that competition with the National Company was desirable and certain to be beneficial, take the bull by the horns and do for the whole kingdom what they are about to do for London, treating the service on the same basis as the telegraph system. And indeed there is much to be said for the proposition. To a certain extent by the passing of the Telegraphs (Telephonic Communication) Bill of 1899, the agreement between the Postmaster-General and the National Company, which to all intents and purposes gave the latter the monopoly in providing a telephone service throughout the kingdom, and at the same time left it open to the former to absorb the company at certain seven yearly periods, under conditions, has been reduced to a nonentity. I believe the last chance of this will occur in 1904, the company's license expiring in 1911. It is pretty unlikely that this action will be taken, but that the company will be allowed to run the course of its legal term, when its business reverts to the government under less onerous conditions. Perhaps the yearly loss entailed by the telegraph service has something to do with the government's modesty as regards the telephone system. But this granting of licenses to individual districts may very well lead to complexities at present difficult to foresee. It is more than possible that no two places will have the same rates, and in many ways intercommunication can be very seriously interfered with. Uniformity of equipment of the various exchanges also is almost out of the question, the result of the difference in views of the particular consulting engineers. No doubt the government, through its advisers, knows its own business, but it might seem very well that in advocating competition with the National Company it was unwilling to take upon itself more than the *origination* of such competition. In treating the telephone business in the same manner as the telegraphs the British public would be guaranteed a cheaper competitive service, whereas in present circumstances I believe that any provincial municipality finding insufficient support or that the company's hold in that particular district too strong for it, is not prevented from discontinuing its service, thus placing the telephone subscribers at the mercy of the company again, a state of things the government is anxious to avoid. Apart from all other considerations, the fact that the postoffice operates the whole of the trunk lines and that eventually almost every municipal authority will control the local lines within its own area opens up the possibility of petty worrying inconveniences which the ordinary subscriber in his pleasure at having two systems is apt to overlook.

In the meantime nothing has been heard of the London postoffice system for a month, although it was fully anticipated that the proposed tariffs would have been made public ere now. We had the statement of Mr. Chamberlain early in the year that the beginning of October would see the system in operation, but since then a month's postponement has been necessary, and it is quite possible that the beginning of 1902 will not be much beyond the mark.

The attitude of the government has served to bring out in strong light the energy of the Chambers of Commerce all over the country, who are exhorting by means of circulars, etc., all the company's subscribers in their own districts to petition for municipal competition. A meeting was recently held of the Associated Chambers of Commerce, *when a resolution was proposed in somewhat strong language* anent the trunk system in Ireland. The gentleman who proposed it stated that the trunk system in the Emerald Isle was not carried to many important towns there, which were without telephonic communication at all. He further remarked that it was plain that since the postoffice had taken over the trunk system it had proved a severe hindrance to Ireland by reason of its utter incapacity to assist in the business of the country.

This same association has been in frequent communication with the Postmaster-General as to the inadequacy of and delays in obtaining connections to the trunk service generally. This subject was referred to in my August notes, but the persistence with which the Associated Chambers of Commerce has stuck to its work has drawn from Lord Londonderry the following full statement of his side of the case. The National Telephone Company's argument is that the Postmaster-General's duty is to connect all towns with the trunk telephone system, but that in nearly all cases he has only brought his wires to one town in an area and that *ex gratia* the company has distributed his trunk messages to the other towns in the same area. The Postmaster-General has replied that the company's attention has frequently been called to the unnecessary delay due to the want of additional junction wires. In many towns additional trunk lines have been provided within the last two years without a corresponding increase in the number of the company's junction wires, so that the number of junction wires is now less than the number of trunk lines, and as during the busiest hours of the day the trunk wires are occupied with a contant succession of calls it is evident that delay must frequently take place because junction wires are not available for the extension of the trunk wires. He goes on that under an agreement dated March 25, 1896, the company bound itself to provide, if necessary, two junction wires for every trunk wire led into a postoffice, but that it has been the practice hitherto not to require more than one junction wire for each trunk wire. However, for some time past the company is said to have failed to comply with this very moderate requirement, with the result that unnecessary delay has been caused in working. Under the agreements made with its subscribers the Postmaster-General asserts that the company has guaranteed, in return for subscriptions, the right of access to the trunk system, and that no other means than the company's junction wires has hitherto existed for securing this access to subscribers in

outlying districts. The general manager of the company has refuted any obligation to do this and the Postmaster-General thinks that this indicates a new view of the responsibilities of the company, both to the postoffice and to its subscribers. These methods on both sides will probably continue until the company has ceased to exist.

In connection with the postoffice system in London it is interesting to observe that the London County Council have communicated with the Postmaster-General to the effect that the council shall be consulted before the rates are fixed. Perhaps this accounts for some of the delay.

At Norwich a company bearing the name of the Norwich Mutual Telephone Company has received a license for Norwich and district from the Postmaster-General. I believe this is the first license to be granted to a company under the new act.

The Tunbridge Wells exchange is proceeding in a very satisfactory manner. There are now over 600 connections, which number exceeds the present total of the company's subscribers.

The London-Brussels telephone cable, mentioned last month, has, according to a London evening paper, broken down under certain tests, which will necessitate the postponement of the opening for a while. I can obtain no confirmation of this, however.

The little fracas between the telephone and fire departments of the Glasgow corporation has had a sequel hardly anticipated by the head of the fire department. The employes of the British Insulated Wire Company, upon whom the fire hose was turned illegally, have each obtained £12 damages.

It is stated that at Hull, where good progress is being made with the installation of the municipal service, there have been as many promises received as there are company subscribers.

In the Midlands combinations of local bodies to work muncipal systems are very prolific. Besides the Manchester combine, which is going ahead steadily, there is an equally extensive one proposed between Bradford, Leeds, Sheffield, Halifax and Hudderfield. At the first conference a report was read detailing the present position and extent of the National Company's business in this part of the country. Resolutions were eventually passed recommending each authority to apply for a license and that the whole shall be worked in conjunction.

The Burnley, Colne, Nelson and Todmorden municipalities contemulate a similar amalgamation; likewise Blackburn and its neighbors, and this method of centralization should undoubtedly tend to diminish the difficulties in the areas covered. The Manchester organization, by the bye, have recommended that a bill be presented to obtain the necessary parliamentary powers, as the postoffice license does not admit of authorities joining hands in this way.

TELEPHONY IN FINLAND.

At Helsinfors the telephone system throughout is on metallic circuits with branching multiple switchboards and self-restoring drops, the equipment of the exchange having been provided by Messrs. L. M. Ericsson & Co. Both overhead and underground wires are employed. The number of subscribers on November 1 was 4,016. The subscription varies from 102 to 90 marks per annum, or (on a system of ownership of instruments by subscribers) the entrance fee is 150 marks and the subscription is 60 marks per annum. Females are employed exclusively as operators. The telephone staff, male and female, numbers 120 employes.

"I am very much pleased with your magazine and hope it will continue as good in the future.

PAUL D. MANLOV,
Galena Telephone Co.,
Weir City, Kan."

DIGEST OF TELEPHONE AND KINDRED PATENTS.

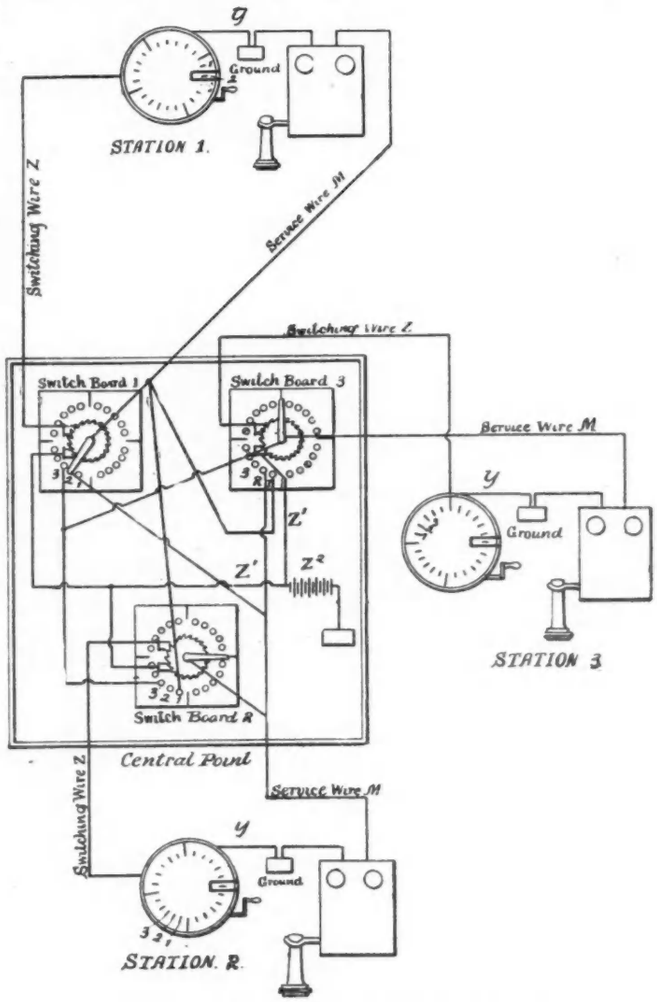
CONDUCTED BY EDWARD E. CLEMENT.

SEPTEMBER 3.

681,951.—E. A. Clark. Electrical Intercommunication.

This is an automatic exchange system having an impulse transmitter at each subscriber's station, and an individual selector controlled by each line, at the central office, whereby the subscriber can connect himself with any other line.

In the diagram y y are subscribers. Each transmitter, as shown at y, has a crank to turn a worm shaft, which



681,951—SYSTEM OF ELECTRICAL COMMUNICATION.

revolves the disc shown until the selected name or number appears in the black bordered space.

The worm shaft carries a contact arm that makes and breaks the circuit twice in each revolution. Each receiver or selector at the central office has a pair of magnets and a step by step arrangement of pawl and ratchet wheel to move a switch arm around to the contact of any line desired.

OCTOBER 1.

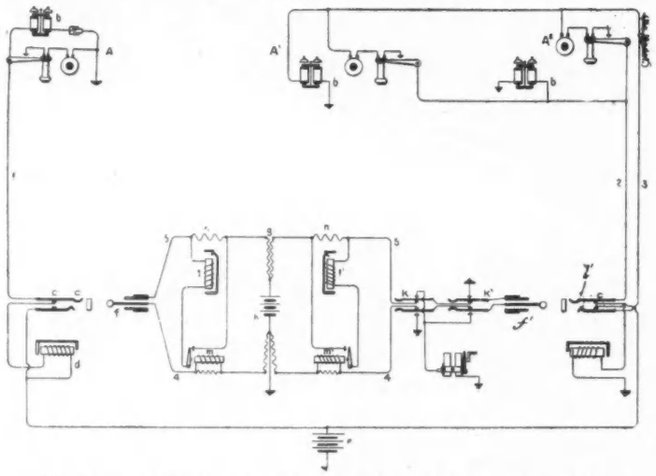
683,480.—F. A. McBerty and J. L. McQuarrie. Supervisory Signal for Telephone Switchboard.

In the diagram A (1) is a grounded line, central energy, and A′ (2-3) is a metallic circuit with party line grounds. It is desired to have the supervisory signals work uniformly under all conditions. The inventors claim to accomplish this by putting relays m and m′ in one side of the cord circuit, and supervisory signals l and l′, controlled thereby respectively, in the other. It is a little difficult to see how this improves the usual series metallic circuit ar-

rangement. In every case where the signal is to be operated the relay must operate too, and in the cases apparent without research, the signals would operate anyhow without the relay. The ringers b b must be high wound in any case.

683,505.—C. E. Scribner. Telephone Circuit.

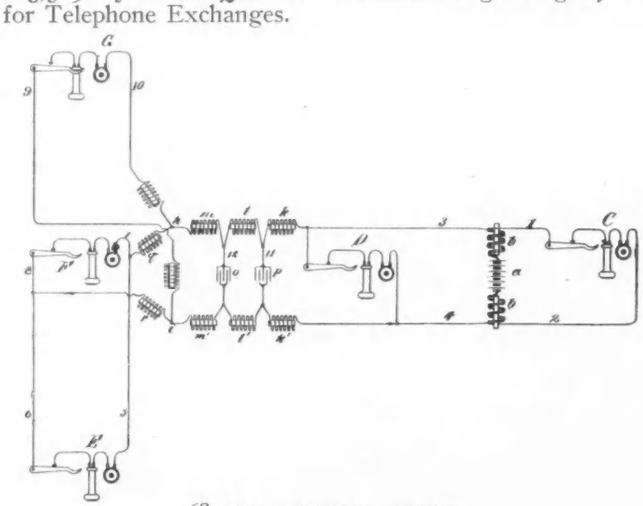
An improvement on patented invention of Scribner & McBerty, 559,410, for a means for "localizing" telephonic currents while permitting a common supply; in other words, for preventing "cross talk" between circuits having the same source of current supply.



683,480—SUPERVISORY SIGNAL FOR TELEPHONE SWITCHBOARD.

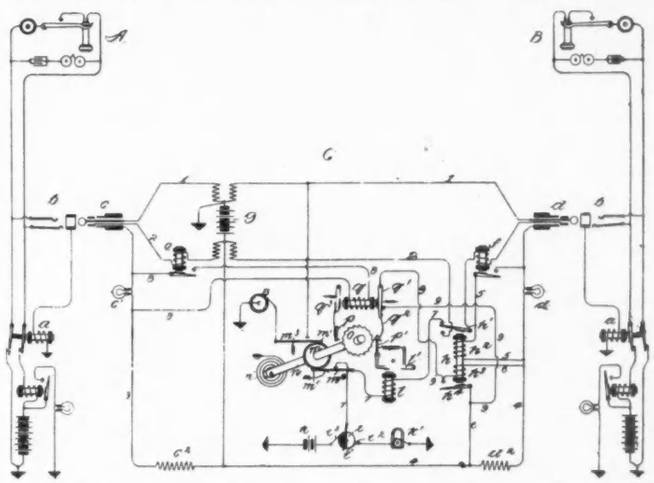
Battery a supplies circuits 3-4, 5-6 and 9-10, all of which are separate and distinct in their use. These circuits are connected in parallel at h and i, and each is provided with impedance coils m m′, q r, etc. In the circuit 3-4 three pair of coils are included, m m′, l l′, k k′, these permitting battery currents to pass, but choking back the speech currents. These would not entirely prevent leakage, however, and to prevent cross talk absolutely bridges 11-12 are put across the line 3-4, containing condensers. These shunt stray voice currents.

683,569.—J. L. McQuarrie. Automatic Signalling System for Telephone Exchanges.



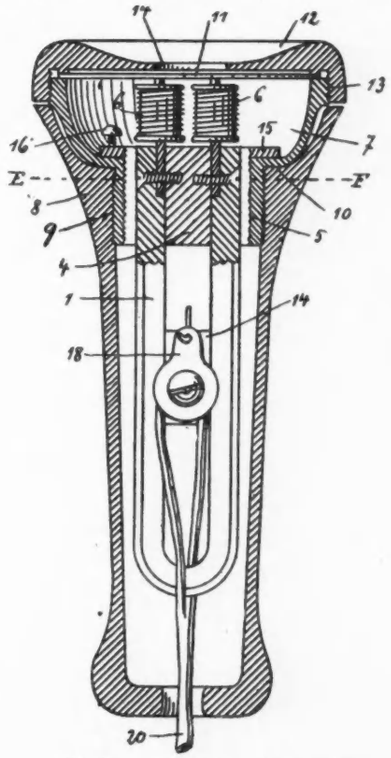
683,505—TELEPHONE CIRCUIT.

This is a device for bringing up and, if the called subscriber does not answer, for informing the calling subscriber of that fact—all automatically and without the operator. n is a shaft, spring held in its normal position; o is a ratchet stepped around by magnet l and armature p′ and held in place by detent p (p and p′ being controlled by magnet q); m is a cam disc on the shaft which in an extreme position pushes springs m^3 against its up contact and spring m^3 away from its contact; s is a sounding device, either phonograph or rotary circuit breaker. When subscriber A calls and plug G is inserted, relay e attracts its armature and closes shunt 8 around lamp G, with magnet q in it. This magnet then pulls up its armatures q^3 and q^1. When plug d is inserted in the wanted jack, ringing current from generator K′ passes by the following path: i^3, i^1, 7, m^2, 7, l, 7, h^1, f, plug tip d, short spring in jack b, to



683,569—AUTOMATIC SIGNALING SYSTEM FOR TELEPHONE EXCHANGES.

station B, through ringer back to jack b by cord conductor 1 to ground through one side of repeating coil. This circuit passes through supervisory relay f and magnet l. The alternating current does not affect the former but it sets the latter to stepping around the ratchet wheel o. A constantly running commutator i is provided, which cuts in



683,631—TELEPHONE RECEIVER.

battery in the circuit described during one-half the time, in order to affect the supervisory relay f when the subscriber answers. When he does so, relay f pulls up, magnet winding h^2 gets current and generator is cut out at armature h^3, while armature h^4 closes on retaining coil h^5. If the subscriber does not answer, the wheel o is stepped all the way around until m^3 is pressed up and cuts in the

answer back "busy" signal s; while the spring m^2 is pressed down to cut out the generator. When the subscriber A hangs up, relay e lets go and magnet q releases its armatures, which release wheel o, to return to zero.

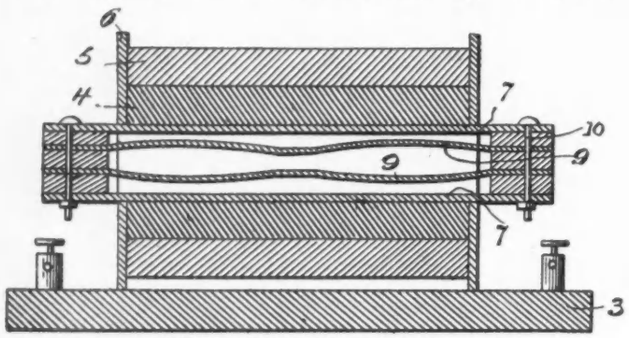
683,631.—H. L. White. Telephone Receiver.

The receiver has a metal cup 7 with a block 4 tapped into it and carrying the magnets and pole pieces, and screw-threaded at 9 for the shell and at 13 for the cap, the metal being thus entirely covered by the rubber.

OCTOBER 8.

683,952.—H. Liebreich. Telephone Transformer.

An induction coil or transformer having its core formed



683,952—TELEPHONE TRANSFORMER.

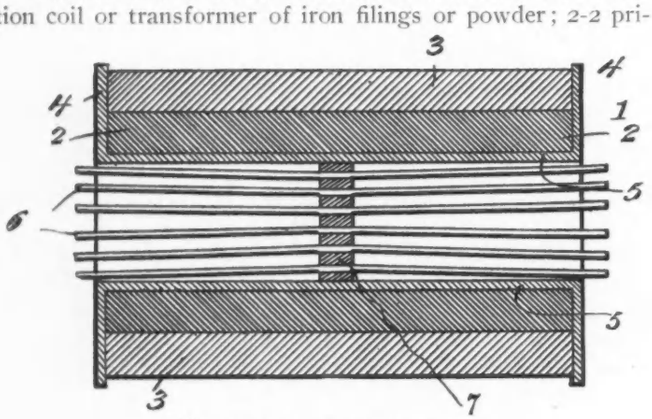
of leaves or laminations 9, free to vibrate in response to the changes in the primary, and thereby, it is stated, imposing a very high variable e. m. f. on the secondary.

683,953.—H. Liebreich. Telephone Transformer.

The core plates of the induction coil in the last patent were held at the ends. This present patent covers plates 6, held in the middle with the ends free to vibrate. The inventor says a loose core of this kind produces greatly augmented effects.

683,954.—H. Liebreich. Telephone Transformer.

In this case Mr. Liebreich makes the core of his induction coil or transformer of iron filings or powder; 2-2 pri-

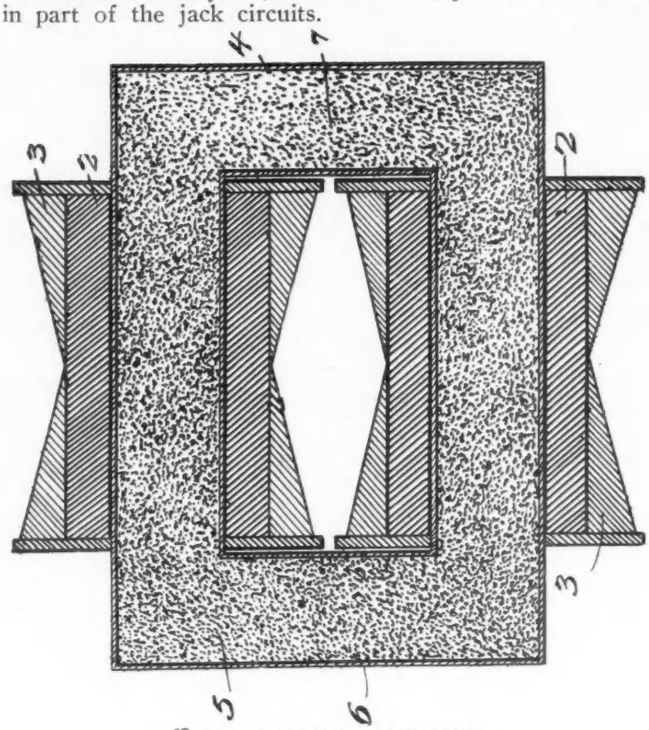


683,953—TELEPHONE PROTECTOR.

mary, 33 secondary, tapering toward the center because that is "neutral;" 6, a casing; 5, filings.

683,969.—W. E. McCormick. Telephone Exchange System.

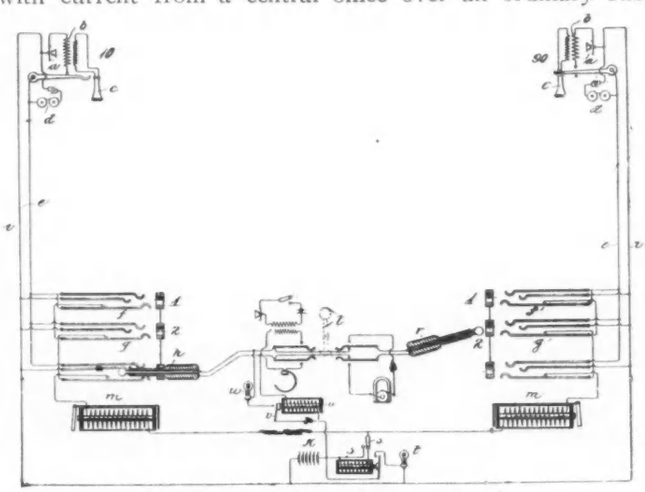
This is a central energy system of the general type employed by Shomberg-Carlson. The idea is to provide a clearing out signal or supervisory that will not require its circuit to be opened when the cord is not in use. To this end, given jack g, with line relay m and main battery k, the supervisory circuit is as follows: k u to cord conductor, to plug sleeve h', long jack spring line e, sub-station apparatus, line i back to battery k. As long as either subscriber keeps his receiver off the hook current flows through relay u, and this keeps open the circuit of lamp w. When both phones are hung up this current ceases, the armature v falls back, and lamp or lights go out when plugs are removed from jacks, because the lamp circuit is formed in part of the jack circuits.



683,954—TELEPHONE TRANSFORMER.

684,111.—C. E. Scribner and J. L. McQuarrie. Telephone Exchange System.

This is a scheme for supplying a branch exchange with current from a central office over an ordinary sub-



683,969—TELEPHONE EXCHANGE SYSTEM.

scriber's line, leaving it possible to use this line and the lines of the branch exchange simultaneously without interference, or to plug any of the branch lines.

PRIMITIVE TELEPHONE LINE.

Monrovia, the capital of the nigger republic of Liberia, on the West Coast of Africa, has enjoyed for the last five months a public service of telephone. The line and apparatus, which are very primitive, were put up by a colored gentleman from the States. Besides joining the different government offices, there are six subscribers, a greater number being debarred from availing themselves of the telephone, it is said, by the high price of subscription, which is equivalent to $60 per annum. The line goes inland for about twenty miles.

THE ORIGIN OF TELEPHONIC NOMENCLATURE.

BY HARRY S. COYLE.

Everything has to have a name, and it makes very little difference what name we bestow upon it, provided that name is generally accepted, and will always stand for that one thing, and nothing else.

Every art and science has a language or vocabulary of its own, and this language is called "nomenclature."

In science great care has been taken to bestow names upon things which will tell what function this or that invention performs. Most names have their origin in some prominent property of the principles and inventions of a science or an art.

Nomenclature is a means, not an end. It has macadamized the rough avenues to knowledge and enables the student to see at a glance the functions and origin of inventions and principles. Nomenclature is an essential part of a science or an art. Telephonic nomenclature is almost free from the outlandish extravagance that pervades many of the arts and sciences. By this I mean that it conforms more to the English language than to any foreign tongue; for the reason that it originated in an English speaking nation.

It is a trite saying that words are the representatives of things and thoughts, and as such we ought to use such words as are intelligible to the mechanic as well as to the scholar.

Very little system has been employed in naming the inventions and principles of telephony. The principle of the system of telephonic nomenclature is that the name shall convey some prominent function or part performed by a device.

In the laws and principles of telephony the names of the discoverers have been applied to the discoveries, such as Ohm's law, Joule's law, the Watt, the Ampere, the Volt, etc. We learn from such terms that the volt and its derivatives originated from Volta, the discoverer, the amperé from André M. Amperé, a distinguished French scientist, and galvanism from Luigi Galvani, a celebrated physicist of Bologna, and in like manner have all such terms originated.

The laws of electricity are analogous to the laws of water; relative to the causes of resistance and action of its current under certain conditions. Many of our mechanical terms in electricity are borrowed from hydraulics. In fact, electricity behaves like an incompressible fluid filling all matter and entangled in an ether that has necessary properties to fulfill the laws and principles of electrification.

The laws of motion and rest are applied to the study of electricity as well as to hydraulics, and are classed under the heads of "Dynamic Electricity" (electricity in motion) and "Statical Electricity" (electricity at rest).

The electromotive force of a current of electricity is the propelling power of the current, and it bears the same relation to a current of electricity that the driving force or pressure does to a current of water. As water flows from a higher to a lower level so electricity flows from a higher to a lower tension, or in other words tends to seek an electrical level.

Electromotive force depends upon the difference of electrical level, or potential, and oftentimes it is called the difference of potential or simply the potential. The term tension is used synonymously with electromotive force. It is necessary to determine the electric unit and to find its mechanical equivalent; therefore, definite units have been established for the measurement of each of the factors of the electric current. The unit of electromotive force is called the volt; the potential or pressage is therefore called the voltage.

A column of water moving through a pipe meets with a certain amount of resistance; so electricity flowing through any conducting medium is more or less obstructed. This principle is called resistance and it varies with the nature of the conductor. Electrical resistance, like water, will vary directly as the length of the conductor, and inversely as its cross section. The unit of resistance is termed the ohm.

The term "current" technically stands for the current strength or the volume of electricity that flows in the circuit. The current strength depends upon the resistance in the circuit and the electromotive pressure under which the current is impelled.

The unit of current is called the amperé, the value of which is the volume of current that flows in the circuit, under a potential of one volt through one ohm of resistance.

As water is measured in pounds, so electricity is measured in coulombs. The electrical unit of work is called the joule; the unit of electrical power or activity is called the watt.

In order to make telephonic nomenclature as intelligible as possible to all nations and to free it from confusion which would otherwise exist, scientific men adopted the Latin and Greek languages in naming a great many of their inventions and discoveries. From the Latin we have such names as transmitter, from the two Latin words, trans, over, and mittere, to send, i. e., to send a message over the line; supervisory, from super, over, and vide, to see; armature is from armatus, armed; condensor, from condenso, to condense; generator, from generatio, to generate; commutator, from commutare, to change, i. e., an instrument for making, breaking or changing the direction of a galvanic current. There are numerous other words of Latin origin used in telephonic nomenclature.

From the Greek we have such words as telephone, adapted from the two Greek words telë, afar, and phoné, a sound, i. e., to send sounds to a distance; microphone, mikros, small, and phoné, a sound, to augment sounds; electricity, elektron, signifying amber, from which Thales, the Milesian made the first recorded observation of electricity twenty-five centuries ago; meter, metron, a measure; dynamics, a force, relating to forces that produce change of motion, such as the dynamo, a machine for transforming mechanical work into electrical energy. There are many other Greek terms used in telephonic nomenclature.

The word relay is from the French term, relais, a relaxation, i. e., a device which is set in motion by one previously at work; battery, batterie, so named from the analogy between the discharge of an electric battery and a battery of cannons.

An analytical study of telephonic nomenclature will reveal many words which have their origin in the English and other modern languages. However, such words are generally accepted by telephonists of all nations and their technical meaning is well understood.

The entire system of telephony may be divided into three divisions: First, the transmitter; second, the receiver; and, third, the switching apparatus. The whole combination of line wire poles, insulators, crossarms, underground cables, conduits, etc., is called a telephone line.

The transmitter transforms the vibrations produced by the sound waves into undulating electric pulses. These currents are transformed back by the receiver into sonorous vibrations. The switching apparatus sends and receives the signals to call attention and makes the necessary changes connecting from signaling to speaking, etc.

The word "armature" has a great variety of applications, from the armature of a simple magnet to the armature of a gigantic dynamo. Little or no system has ever been employed in the use of this term. Originally the word is from the Latin and means "armed," hence a protection.

In telephony, as elsewhere, words ending in *er* and *or* denote some special act or function performed by an invention, such as generator (to generate), insulators (to interrupt the passage of electricity), conductor (to facilitate the passage of electricity), receiver (to receive), volt-meter (to measure the voltage), ammeter (to measure the amperage), and so on. The word ammeter is a contraction of amperé-

meter, and refers to an instrument for measuring amperes. The word "magnet" is from Magnesian, a country in northern Greece, where the loadstone was first discovered.

The words and signs of positive (+) and negative (—) are of mathematical origin and are used to distinguish the two kinds of electricity.

The nomenclature of plates and poles is of a somewhat chaotic nature. However, this difficulty readily disappears when we remember that in any part of a battery circuit the point from which the current flows is called the positive pole, the collecting plate, or the cathode, or it may be distinguished by the positive sign (+).

The point toward which the current flows, or the plate upon which the greater chemical action is exerted is called the negative pole, the negative plate, or the anode, or it may be denoted by the negative sign (—).

The wires attached to the two plates, or any other apparatus in which they terminate, are called the negative and positive electrodes. The current is said to pass from the negative to the positive plate in the battery, and from the positive to the negative in the connecting wire, or the apparatus outside the battery. The exciting liquid, the two plates and the connecting wires, with any conducting apparatus that may be interposed in the course of the wire is called the circuit. The circuit is said to be closed when the conducting circle is complete. It is open, or broken, when it is interrupted at one or more points. The words "multiple and series" are also of mathematical origin and have reference to the like and the unlike, as carbon connected to zinc, or the negative pole connected to the positive pole in a battery. Instruments are said to be arranged in series when they are so connected in circuit that the current runs through them successively. An instrument is in series when it is placed in one side of the circuit. Instruments are said to be arranged in multiple, or in multiple arc, or in parallel, when two or more are so connected as to form bridges or arcs between the two sides of the circuit. When we speak of multiple electric transmission we mean that the electric pulses agree with each other in each successive period and phase throughout their entire course, as from transmitter to receiver. In fact, electric pulses are analogous to the action of sound waves in the air, and have been studied and measured in very much the same manner.

By multiple switchboard we mean a switchboard that contains a subscriber's nunmber more than once, which is arranged in different positions on the switchboard so as to be within reach of each operator. Some multiple switchboards have as high as fourteen reproductions of the same number.

The word telephone is not only applied to the electric telephone, but to any instrument that is adapted to the transmission of sound, electrically or otherwise.. In order to obtain a good understanding of the origin of telephonic nomenclature we must remember that the idea of transmitting sounds telephonically is almost as old as history. To be sure, such transmissions were within narrow limits, and certainly do not exceed the range of a speaking tube.

Telephonic nomenclature has by no means reached its acme. Even now we find such words as "telephrone," "telephome" and "telephem" struggling with each other for existence, as the name of a telephone message.

No attempt has been made in this theme to give a complete synopsis of telephonic nomenclature. Such an article would be impractical as well as dry and uninteresting.

DIVISIONS AND SUB-DIVISIONS OF TELEPHONY.

- Telephony.
  - 1. Transmitter.
    - Microphone.
    - Batteries.
    - Transmitter arms.
  - 2. Receiver.
    - Hook and switches.
    - Ringing coils and bells.
    - Generator.
  - 3. Switching apparatus.
    - Answering and multiple-jack.
    - Cable and wiring.
    - Line drops or signal lamps.
    - Supervisory relays and lamps.
    - Connecting cards.
    - Condensers.
    - Buzzers.
    - Clearing-out drops.
    - Listening and ringing keys.
    - Impedance coils.
    - Repeating coils.
    - Induction coils, etc.
      - Distributing boards.
      - Connecting racks.
      - Cables.
        - Line relays.
        - Relay racks.
        - Cables.
      - Power board.
      - Switches.
      - Ammeter.
      - Voltmeter.
      - Ringing and charging machines.
        - Terminal-heads.
        - Cables.
      - Storage batteries.
      - Starter.
      - Transformers.
      - Fuse boards.
  - Induction coils.
  - Condensers.
  - Subscriber box station.
  - Lightning arrester, etc.
  - Line wire.
  - Poles.
  - Cross arms.
  - Pins.
  - Insulators.
  - Underground conduits.
  - Cables.

DECISIONS AFFECTING TELEPHONY.

PREPARED FOR TELEPHONY BY ANDREWS & MURDOCH, BERRIEN SPRINGS, MICH.

INJURIES FROM IMPROPERLY INSULATED WIRES.

While at work on the line of the Bell Telephone Company, in Wake county, North Carolina, in stringing a wire upon its line across and over the wires of an electric light company, the wire being strung by a lineman came in contact with the wire of the light company at a point where the latter had negligently permitted its wire to be and remain uninsulated. As a result of the contact the wire of the telephone company became charged with electricity, and the charge was conveyed into the body of the lineman, causing his death. Action was brought against the electric light company for the killing of the lineman and judgment rendered for the defendant. On appeal the judgment was set aside. In rendering its opinion the Supreme Court of the state said: "The defendant company was engaged in the business of manufacturing, producing, leasing and selling light made from the use of electricity, which is the most deadly and dangerous power recognized as a necessary agency in developing our civilization and promoting our comfort and business affairs. It differs from all other dangerous utilities. Its association is with the most inoffensive and harmless piece of mechanism—if wire can be classified as such—in common use. In adhering to the wire, it gives no warning or knowledge of its deadly presence. Vision cannot detect it. It is without color, motion or body. Latently, and without sound, it exists, and, being odorless the only means of its discovery lies in the sense of feeling, communicated through the touch, which, as soon as done, becomes its victim. In behalf of human life and the safety of mankind generally, it behooves those who would profit by the use of this subtle and violent element of nature to exercise the greatest degree of care and constant vigilance in inspecting and maintaining the wires in perfect conditon."

FRANCHISE—REMOVAL OF POLES.

The Duluth Telephone Company was organized under title 1, c. 34, Gen. St. 1878, before section 28, c. 34, Gen. St. 1866, was amended by chapter 73, Gen. Laws 1881. By a special act, approved March 7, 1881, the exclusive right was conferred upon the company to erect its poles and wires upon the streets of the city for the period of ten years, which right was extended for the further period of ten years by a special act approved April 13, 1889. Commencing in 1882, under the authority of both the general and special acts, the company con-

structed its telephone system within the city, and has since maintained and continued to extend the same therein. The time granted under the special acts having expired, on November 29, 1898, under the provisions of chapter 74, Gen. Laws 1893, the common council offered to sell a franchise to construct a telephone system within the city upon certain conditions; and, defendant having refused to submit a bid, the franchise was granted to another company, which thereupon constructed a telephone system, which it has since maintained and operated. On February 13, 1900, the city council passed a resolution requiring defendant on or before April 1, 1900, to remove its poles and wires from the streets, avenues and alleys of the city. Upon defendant's refusal to comply with the order, the city commenced an action to enjoin defendant from further extending its system, and to compel the removal of the poles and wires already erected. *Held* (87 N. W. Rep., 1128): 1. That section 28, Gen. St. 1866, as amended by chapter 73, Gen. St. 1881 (section 2641, Gen. St. 1894), authorized defendant to enter upon the streets and alleys of the city and erect its ploes and wires therein, subject only to the police power of the city to control and regulate the same. 2. The company having established its plant in reliance upon the provisions of the general law (section 2641, Gen. St. 1894), such action on its part constituted an acceptance of the right or privilege thus granted, and its occupancy of the streets thus acquired, including the right to extend its system within the city as occasion might require.

TELEPHONY'S EASTERN MANAGER.

In this issue we publish the portrait of Mr. F. M. Rounthwaite, the eastern manager of TELEPHONY, who has

F. W. ROUNTHWAITE.

recently opened offices in the St. Paul building, New York. While a comparatively young man, Mr. Rounthwaite is well known in the telephone and electrical field, and has pushed his way rapidly to the front. Telephone men visiting New York are invited to make TELEPHONY'S eastern office their headquarters, where every consideration will be shown them.

WELL-KNOWN HEADS OF WELL-KNOWN HOUSES.

A BIOGRAPHICAL SKETCH OF G. W. SUTTON.

One of the best known telephone men in the East is Mr. G. W. Sutton, president of the Phœnix Electric Telephone Company of New York. Mr. Sutton was born in

G. W. SUTTON.

New York December 4, 1862, but was educated in Europe at Frankfort on the Main. He entered the Independent telephone manufacturing field in November, 1894, in association with Mr. Scofield, organizing the Phœnix Electric Telephone Company. The growth of the company has been rapid and its present position in the Independent field is due to the business judgment and preseverance of Messrs. Sutton and Scofield. Among the recent installations of the Phœnix company might be mentioned Columbia, South Carolina, 1,000 lines; Poughkeepsie, New York, 700 lines; Newberg, New York, 700 lines. Mr. Sutton's success has been well earned, and is the result of keen business ability and perseverance.

INDEPENDENT TELEPHONE MEN ORGANIZE.

The representatives of twenty Independent telephone companies of central Missouri have lately held a convention at Sedalia, with F. A. Churchill of St. Louis as presiding officer. The object of the meeting was to organize an Independent line association for mutual protection and to discuss ways and means of establishing a long-distance Independent line.

FACTORY OF FRANK S. TUCKER & COMPANY.

In the following illustration is shown a section of the factory of Frank S. Tucker & Co., Boston, Mass., manu-

SECTION OF FRANK S. TUCKER & CO.'S FACTORY, BOSTON.

facturers of telephone specialties, transmitters, automatic switches, push-buttons, etc. This company is well known as one of the prominent manufacturers of telephone parts and electrical specialties in the East.

PHONO ELECTRIC WIRE.

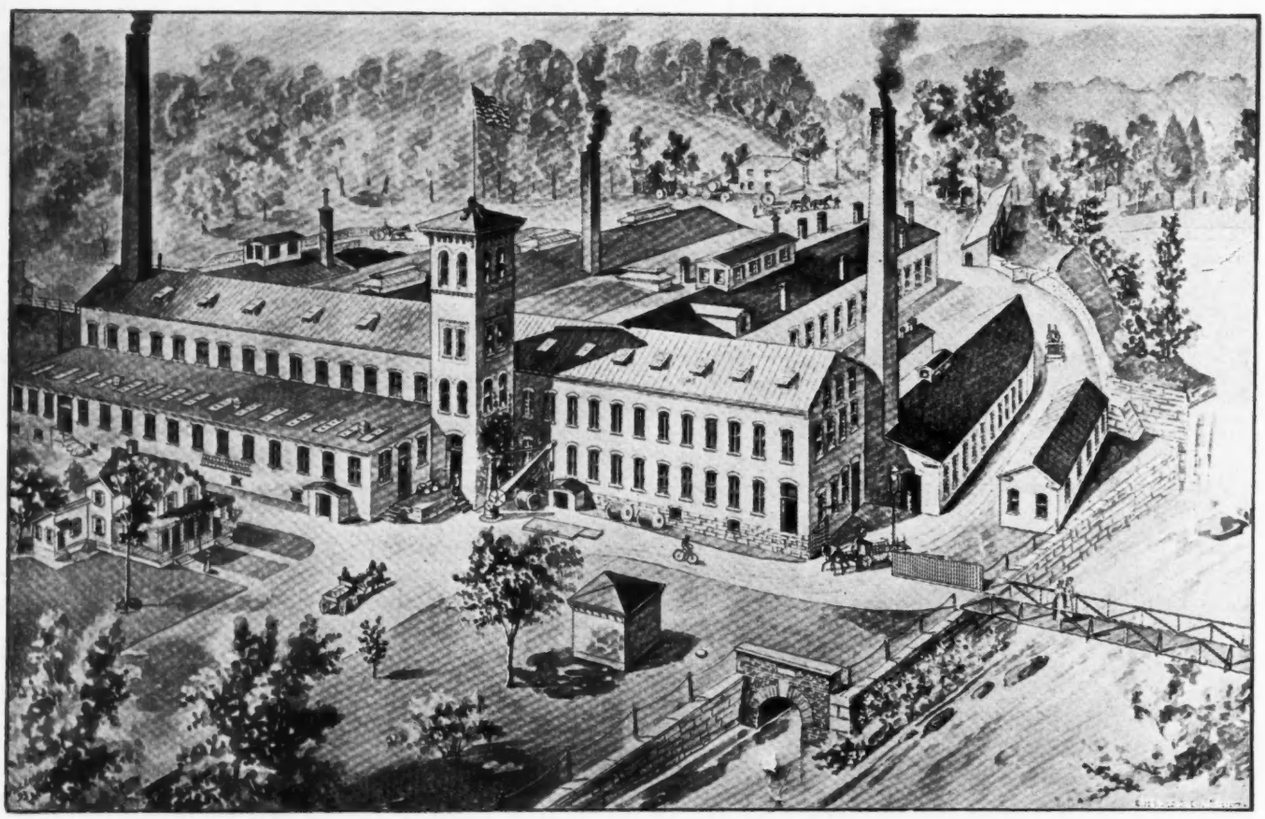
"Phono-Electric" wire is made by the Bridgeport Brass Company, with general sales offices at 19 Murray street, New York, and mills at Bridgeport, Conn. This wire is being used extensively by the telephone and telegraph companies for line wire, and also for outside twisted pair distributing wire, and for lines in exposed and troublesome places.

"Phono-Electric" is a reliable wire, and can be depended upon to give security and permanence to all lines. It combines high tensile strength, high elastic limit, and great toughness with remarkable wearing qualities. It is homogeneous throughout and does not depend upon a hardened skin for its strength, as do some other drawn wires. Have you one of the "red" booklets which gives data, weight, etc., on "Phono-Electric" wire? This booklet is being sent free, postage paid, on application.

TELEPHONING IN RUSSIAN.

Discussions and stories of a linquistic character have a peculiar charm for Mr. Opie Read. Recently he was surrounded by a group of newspaper men. One of these confessed that he had lately taken up the study of the Russian tongue, with very discouraging results, considering the fact that French, Spanish and Italian had been comparatively easy for him.

"Oh, that's not strange," consolingly remarked the story writer; "the Chicago Telephone Company had a worse experience than that with the terrors of the Slav tongue. A druggist in the heart of the Russian colony recently had a telephone instrument installed in his place for the accommodation of his patrons. The minute the first user of the 'phone began to talk Russian into the receiver the wire kinked into small knots like a tensely twisted string. They couldn't do a thing to meet the emergency until one of the telephone linemen, who had once attempted to do missionary work in a Russian settlement in Minnesota, replaced the smooth insulated copper strand with the ordinary barb wire. That jagged medium proved a perfect means of transmission for Russian speech."



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THE NEW YEAR.

To telephone men the world over the new year opens with abundant promise of prosperity, while to the Independents the outlook is especially bright. From the manufacturers' standpoint, the prospects could not be better. Nearly all the factories are running overtime to keep up with orders, while exchange men are more active than at any time since the movement began. The patent situation has cleared up and the Independent business is now on a firm footing. To everyone we wish full measure of success and a happy new year.

EXTORTIONATE TELEPHONE CHARGES.

It is with eminent satisfaction that the patrons of that thrifty corporation, the Chicago Telephone Company, will receive the news that a judicial opinion has been secured as to the validity of the company's practices. In granting a temporary injunction restraining the company from charging more than $125 a year for its service, Judge Tuley declares that as a public corporation the company was bound to give telephone service at the rate fixed by its ordinance. The court holds, also, that "when a subscriber cannot obtain satisfactory service except by entering into a contract by which he agrees to pay a greater rate than that fixed by the ordinance, the rate agreed to be paid, so far as it is in excess of the rate prescribed by the ordinance, must be held to be an illegal exaction and not only illegal but forced—a forced agreement by the company exacted of the subscriber and not a voluntary contract which would estop him from disputing the same."

This seems to dispose pretty effectually of the company's contention that in furnishing "improvements" upon its inefficient service it was doing more than its contract obligations required. The proposal to grant the "improvements" at a charge of $175 a year, virtually forcing the subscriber to pay more or accept inferior service, seems to have been framed on the pleasant assumption that the company is not obliged to give good service except in the cases where it has been propitiated by additional tribute.

The telephone service in this city is unsatisfactory at the best. From the petty extortion of the slot machines to the larger imposition of the $175 rate, the company has missed no chance to grab the people's dimes and dollars, and the public has been obliged to accept whatever in the way of service the company saw fit to provide. It is gratifying to know that under the law the public has some rights in the matter.

Judge Tuley granted a preliminary injunction on January 7, restraining the Chicago Telephone Company from charging more than the franchise rate of $125 a year for its business service. The injunction had been sought by the Illinois Manufacturers' Association and more than sixty individual business firms on the ground that the ordinance passed by the city of Chicago in 1899 provided that the telephone company should not charge more than $125.

The Chicago Telephone Company, in the opinion of Judge Tuley, is a public service corporation, amenable to the ordinances passed by the city to regulate its streets, and has no right to charge a price greater than that fixed by the ordinance. In referring to the ordinance of 1889, Judge Tuley says in his opinon:

"Not being a private contract or a contract separate and apart from the exercise of the governing power of the city, the doctrine of practical construction and acquiescence contended for by the defendant can have no application, because as a public service corporation it was bound to give telephonic service at the rate fixed by the ordinance. When a subscriber cannot obtain satisfactory service except by entering into a contract by which he agrees to pay a greater rate than that fixed by the ordinance, the rate agreed to be paid, so far as it is in excess of the rate prescribed by the ordinance, must be held to be an illegal exaction, and not only illegal, but forced, a forced agreement exacted by the company of the subscriber, and not a voluntary contract which would estop him from disputing the same.

"In the language of the Supreme Court, where a public service corporation exacts greater charges than are authorized by law the payment of such charges is not regarded as voluntary nor is the making of any protest or objection necessary in order to recover back the excessive charges.

"Without reviewing the evidence in detail," Judge Tuley continued, "it is sufficient to say, among other things, that it clearly appears that the grounded line telephone service, as it existed in 1899, gradually became more and more inefficient and unsatisfactory. This was caused by the intro-

duction of wires for electric lighting and railway service, and the steadily increasing multiplication of iron pipes and conductors of electricity being placed in and over the streets and alleys of the city of Chicago.

"The defendant's answer in connection with the evidence clearly shows the inadequacy and inefficiency of the old service for the changed condition of affairs.

"The improvements which the answer alleges were made in the old or grounded service by the defendant, and for which it appears the defendant made no extra charges to subscribers, must be held to have been made to advance its own interests as well as in the performance of its duty to give telephone service at the rate of $125 per annum. The fact that it made no charges for such improvements in the grounded line circuit must be taken as a recognition of its duty and obligation to give an improved service, and remedy defects in the then existing service when it was practicable to do so, and this without extra charge therefor. It was equally as strong a practical construction of the ordinance as the special contracts which were entered into after the passage of the ordinance in question.

"It also clearly appears from the evidence that all these improvements in the service were not only demanded for the satisfactory service to subscribers, but also that they were made by the telephone company in its own financial interest and for its own advantage."

In speaking of what the city council probably contemplated at the time the ordinance was passed, Judge Tuley said:

"It was well known at the time of the passage of the ordinance that copper was a much better conductor of electricity than iron, and that a return wire was much better than a grounded circuit; that a Blake transmitter was better than those that preceded it, and that improvements in telephones and telephone appliances were continually being sought for and discovered; that the art of telephoning was yet in its infancy, and that the future was rich in promise of its growth and improvement.

"The attention it was receiving from scientific experimenters, the history of the growth of the telegraph, of the railroad, of the steam engine and other great improvements, all these matters must be held to be part of the 'surrounding circumstances' in which the ordinance in question was passed and accepted, and which are to be considered in arriving at the intention of the parties."

According to Judge Tuley, the Chicago Telephone Company well knew the inefficiency of the ground circuit service and made statements to this effect in its directory. The court said on this point:

"That the grounded line service was steadily becoming more and more inefficient and unsatisfactory and that the defendant found it to the interest of the company to encourage the demands for more efficient and satisfactory service is conclusively shown by the annual reports of the directors and official documents issued by the company, which have been introduced in evidence."

"In the defendant's telephone directory, issued in October, 1901," the judge declares, "occurs the following:

"'On account of interference by currents from electric railways, lights and other electric systems, it is not possible to insure satisfactory communication by subscribers having grounded exchange lines. The character of the service in such cases will depend largely upon the local interference encountered.'"

"In the face of this showing," continued Judge Tuley, "and admissions by the telephone company, it would be forced construction, if any construction is necessary of the ordinance in question (which the company insists is a mere private contract between it and the city), to hold that the telephone company's only duty or obligation as to furnishing 'telephone service' is to furnish the grounded line service in existence when the ordinance was passed.

"I find no such provision in the ordinance (which could easily have been inserted had such been the understanding), nor do I find any provision or contract to furnish an inefficient or unsatisfactory telephone service."

In passing upon the contentions of the telephone company regarding its long-distance service, the court said:

"The defendant alleges that it made an arrangement with the American Telephone & Telegraph Company for such connection and combined service. It appears that that arrangement was made as early as 1891, more than a year before the long-distance telephone arrived in Chicago, and it must be presumed that it was made by the company voluntarily and because it was for its advantage to make it; also that it took care of its own interests in arranging the terms of the agreement."

The basis of injunctional proceedings is the ordinance of 1899, by which the Chicago Telephone Company agreed to furnish its service to patrons in the downtown district for $125 a year. The bill was signed by more than thirty business firms when it was filed, and later this number was increased to more than sixty. The two principal complainants were the Illinois Manufacturers' Association and the city of Chicago, the former being represented by the firm of Moran, Mayer and Meyer. Among the complainants who joined in the suit were the Chicago Consolidated Bottling Company, the Chicago Screw Company, Continental Bolt & Iron Works, Fitz Simons & Connell Company, Goss Printing Press Company, Union Drop Forge Company, Binner Engraving Company, Gahan & Byrne and F. Herhold & Sons.

It was alleged by the complainants that the charter of the company gave it no right to lay its main in the public streets and that these privileges were granted to the company by an ordinance which is incorporated in the bill of complaint. The governing paragraph of this ordinance, which was passed in 1899, is as follows:

"And said company, during the term for which this ordinance is granted, shall not increase to its present or future subscribers the rates for telephone service now established."

Notwithstanding the legal obligation resting on the ordinance and its acceptance by the telephone company, it was alleged that in the business district the complainants were being charged $175 a year for the telephones which they should be able to lease at $125. It was averred that the exaction of a greater sum than $125 was against public policy and in violation of the terms and conditions under which the company obtained the right to construct and maintain its telephone system in the city.

In answer to the arguments of the Illinois Manufacturers' Association, the Telephone Company admitted there was a city ordinance declaring that the price for telephone rental should not exceed $125 a year, but it is asserted that when this ordinance was passed the only kind of a telephone then in use or whose use was contemplated was the "ground circuit." This class of 'phones, the company asserted, it was willing and had always been willing to install for $125 a year.

The company then related in detail the cost of installing the metallic circuit telephones and the great additional advantages offered to subscribers in this kind of service. The telephone company argued that it was not compelled by any contract or ordinance to install this class of service and did so solely because its subscribers made a demand for it. A special contract was used, the company said, in making agreements with prospective subscribers to this kind of service and an extra charge made on account of the additional expense and the great advantage offered over the old system.

In the hearing before Judge Tuley Attorney Mayer caused the contract of the Chicago Telephone Company with the American Telegraph and Telephone Company to be produced in court and sought to show by its terms that the Chicago Telephone Company received a certain per cent of the toll charges for all long-distance connections beginning at its end of the line.

This evidence was considered of great importance by the attorneys for the prosecution in that it showed that it was to the interest of the Chicago Telephone Company to have

as many metallic circuit 'phones installed as possible in order to secure the benefit of the percentage on the toll charges.

"It is a great victory for the business men," said former Judge Moran. "The whole question was clearly decided by the court, and securing a permanent injunction will now be only a matter of course."

The question of the size of the bond to be furnished by the complainants was left to the parties to the litigation, and it is probable that this will be decided in court shortly.

The Illinois Manufacturing Association protested against the charges imposed by the Chicago Telephone Company as far back as 1898, but not until last July did the association decide to test the matter of rates in the courts. One week was devoted to the argument of the case before Judge Tuley in the early part of November, since when it has been under advisement.

THE MURDOCK SOLID RECEIVER.

The advancement made in improving and perfecting telephone apparatus in the last ten years has been truly wonderful. No other branch of the electrical business can show equal progress and no other electrical invention has been so useful. The telephone has been on the market for about twenty-five years, and while its usefulness was considered limited by many people in the early times, it is now acknowledged to be an absolute necessity and quite indispensable. For many years the telephone business in this country has been controlled by one concern, and while many improvements were made during that period, it can be said that much more progress has been attained in this line within the last ten years. One of the latest improvements in telephone apparatus is a receiver in which the parts are molded in the case.

The receiver, besides being the most sensitive part of the telephone, is the one handled most, and generally with less care than caution. The old style receivers have given much trouble to those employing them. If the instrument happened to drop, the case would be broken or a screw working loose would render the receiver inefficient. In the Murdock solid receiver, injuries from any source are reduced to a minimum, for the binding posts, magnet, connecting wires, etc., are molded in the case. The advantage derived from this can readily be seen; the case cannot be broken; nor can the adjustment change, since the distance from the pole pieces to the diaphragm always remains the same.

The solid receiver is made in different styles and has been on the market for nearly a year. It is largely used in exchanges in this and foreign countries. William J. Murdock & Co., of Chelsea, Mass., are the manufacturers, and will be pleased to give any information regarding it to those interested in receivers.

MONARCH BUILDING.

The Monarch Electric & Wire Company, 125-127 South Clinton street, Chicago, manufacturers of "Monarch Brand" weatherproof wire and dealers in electrical supplies and material, report a heavy year's business. The accompanying illustration shows the company's new building, the entire four floors and basement being used exclusively by them. The officers of the company are: Samuel Mankowitz, president and treasurer; M. I. Mankowitz, vice-president, and Joseph Cohen, secretary. Provision has been made to handle all orders promptly and correspondence is invited from prospective buyers.

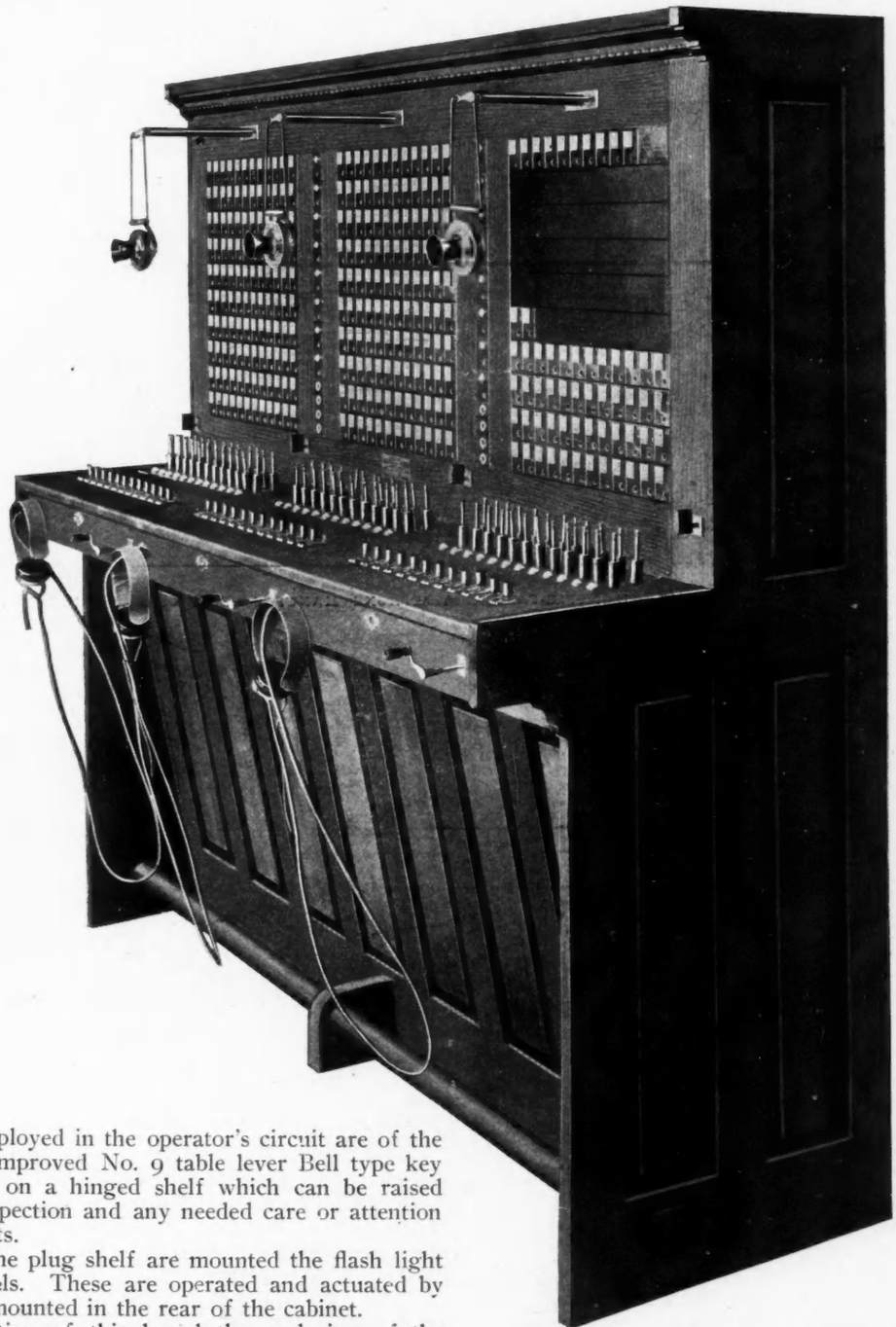
MONARCH WIRE & ELECTRIC COMPANY'S BUILDING.

THE STANDARD TELEPHONE AND ELECTRIC COMPANY, Madison, Wis., is now running its factory full and overtime filling orders. Contracts have been closed to furnish switchboards to the Marquette and Ishpeming, Michigan, exchanges, and large orders for telephones are being filled for various points in Michigan, Wisconsin, Kansas and West Virginia. One of the specialties of the "Standard" is a special type of telephone adapted for use on farmers' lines. Business with this company is most gratifying and the outlook for continued large business during 1902 is extremely good.

NEW EUREKA EXPRESS SWITCHBOARD.

The accompanying cut shows the Eureka Electric Company's new express switchboard with electric light clearing out signals. The switchboard, it is claimed, contains many valuable improvements over the ordinary type of express switchboards and central office equipments.

The cut illustrates a regular 360 line capacity cabinet giving 120 line signals to each operator, and also has trunking capacity for 720 lines.



The cams employed in the operator's circuit are of the company's latest improved No. 9 table lever Bell type key and are mounted on a hinged shelf which can be raised at will for the inspection and any needed care or attention to the cam circuits.

In front of the plug shelf are mounted the flash light clearing out signals. These are operated and actuated by relays which are mounted in the rear of the cabinet.

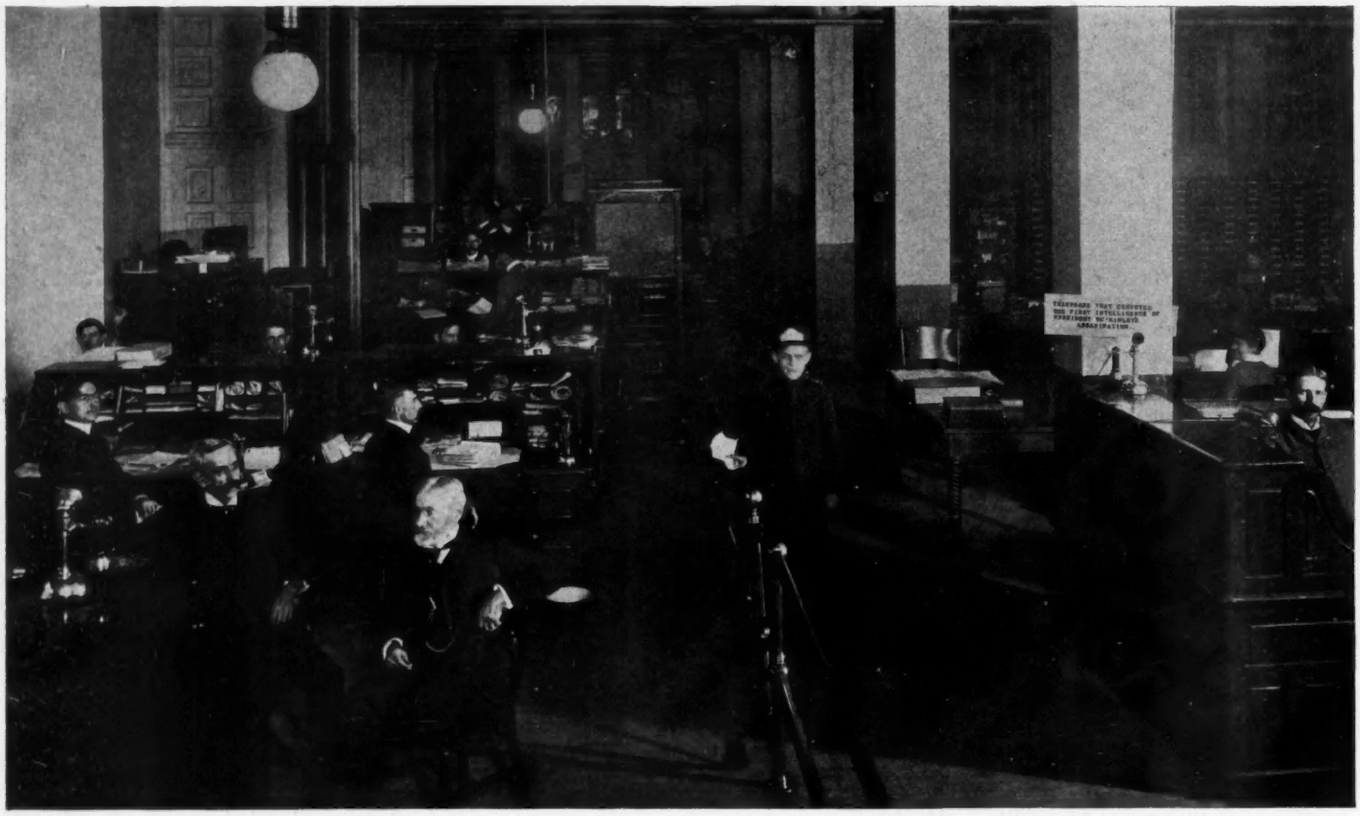
In the operation of this board the replacing of the receiver upon the hook with the plugs in circuit lights a lamps which shows through an opalescent glass and which remains lighted until the operator withdraws the plug when it is automatically extinguished, allowing the relay contact to drop away .

The rapidity of the operation of a board equipped with flashlight clearing out signals is such that an operator can handle from 120 to 160 subscribers.

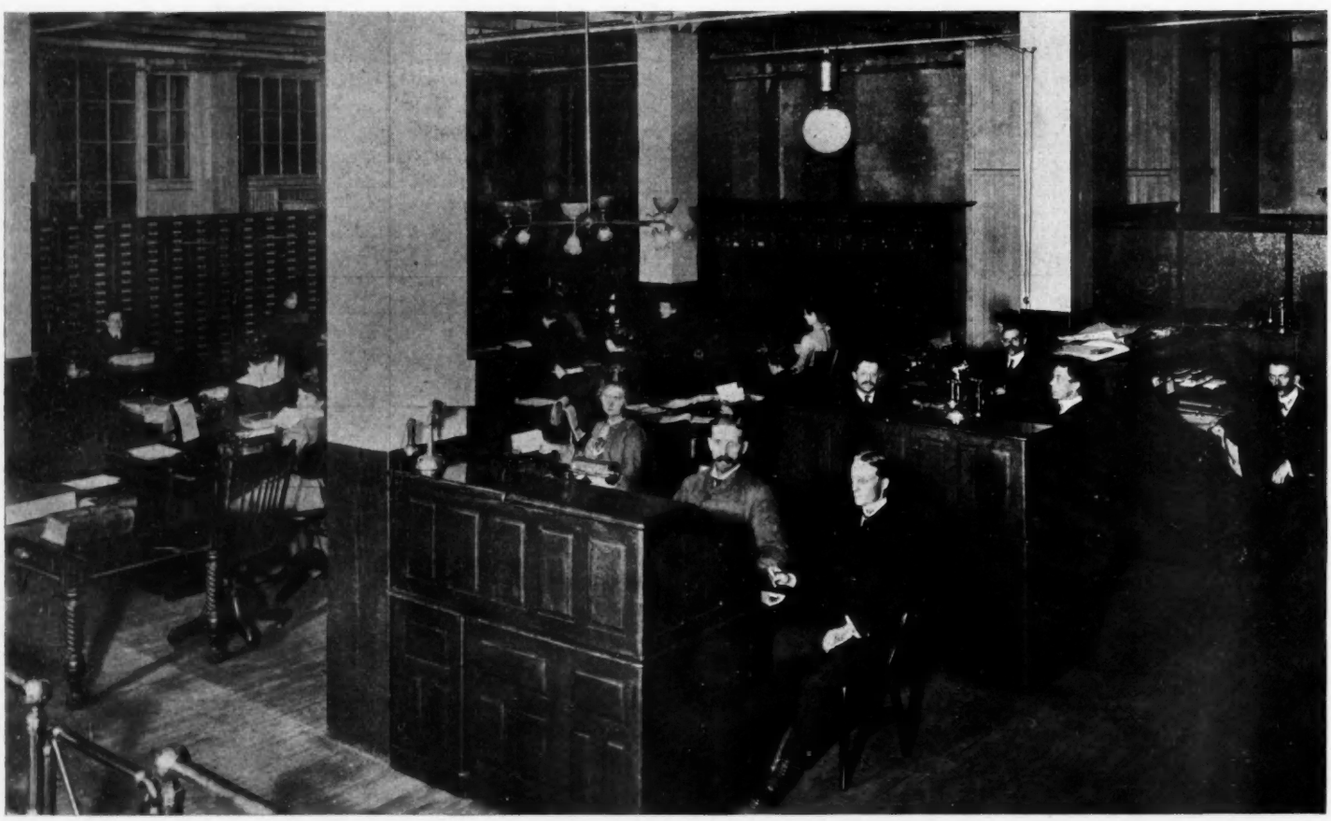
The transfer employed in this board is of the self-contained automatic cut-off relay type and the operation is as follows: An operator desiring connection with another board in the system inserts a plug into the jack of the transfer relay, lights a lamp on both her board and the board with which she desires connection; the instant that the called operator answers both lights are automatically extinguished. This simple flashlight relay transfer system makes it impossible to hang up the subscriber or a pair of cords without the signals remaining lighted.

The cabling throughout this switchboard is done with silk and cotton insulated wire, all joints are soldered to their respective terminals, and it is the claim of the company that they do not allow any soldering to be done with acids, in consequence avoiding any difficulty arising from such use.

This switchboard, as well as all the Eureka apparatus, is illustrated and described in a new catalogue which the company will send to any part of the world upon request.

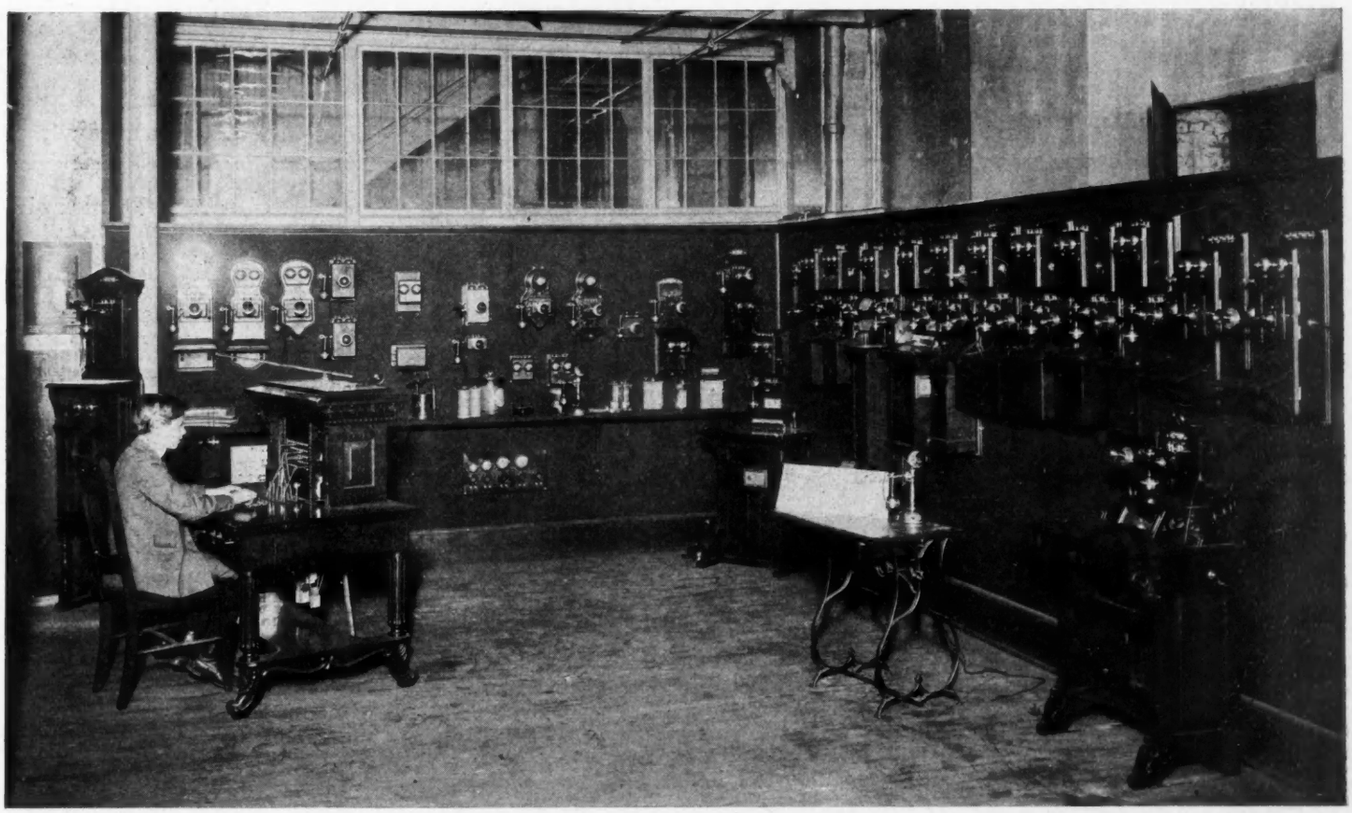


ACCOUNTING DEPARTMENT—STROMBERG-CARLSON TELEPHONE MANUFACTURING COMPANY, CHICAGO.



SALES DEPARTMENT—STROMBERG-CARLSON TELEPHONE MANUFACTURING COMPANY, CHICAGO.

CORRESPONDENCE DEPARTMENT—STROMBERG-CARLSON TELEPHONE MANUFACTURING COMPANY, CHICAGO.



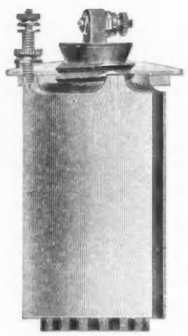
DISPLAY ROOM—STROMBERG-CARLSON TELEPHONE MANUFACTURING COM PANY, CHICAGO.

THE SAMSON BATTERY.

From a small beginning the Samson battery, patented July 8, 1890, and September 22, 1896, has grown in favor until it has, it is claimed, attained the enviable position of the acknowledged leader of all batteries of its class, notwithstanding the fact that at first it received the adverse criticism of many, owing to its use of a corrugated carbon and circular zinc. Speaking of its merits the manufacturer says:

Success has been achieved through the ability of the French manufacturers to produce a porous and absolutely uniform carbon, through our persistent efforts to increase

NO. 2 SAMSON BATTERY.



CARBON ZINC AND COVER.

the efficiency of the battery by improving its mechanical construction, and, more important than either, through the remarkable strength and great length of life of the carbon. It is not unusual to receive information that Samson batteries have operated combined gas-lighting and bell installations continuously for from three to five years, and given perfect satisfaction during that period.

The No. 2 cell has a voltage of from 1.40 to 1.47, and

CARBON READY FOR REPLUGGING.

DEPOLARIZING COMPOUND.

SPECIAL SAMSON ZINC.

an ampereage on short circuit of from 12 to 16 amperes. As this battery is intended solely for intermittent work, this large current is but momentary.

The battery has a wide range of usefulness, operating successfully every electrical device requiring intermittent battery service, including bells, annunciators, electric gas lighting, gas engine ignition, etc., and has proven eminently satisfactory for closed-circuit work in connection with telephone transmitters, so much so that it has been adopted by many telephone exchanges in all parts of the country.

The improvements in the Samson consist in so joining the elements and cover that they cannot short-circuit inside of the jar; dispensing with all rubber rings or plugs; placing outside binding posts on the carbon; furnishing charges of depolarizing compound by which carbons can be easily recharged; placing sal-ammoniac inside of the jar, and shipping battery "set up" ready for immedite use.

Like every other meritorious article the Samson has its imitators. The name, the label, the size (No. 2) and the form of elements have all been copied by American carbon manufacturers with some degree of success as regards appearance, but the porosity of the carbon and the results obtained from the battery have proven failures.

The Samson carbon is manufactured in France. It is composed of two parts, a fluted lower portion and a threaded top, which are baked into one piece in the kiln. This feature is unlike any other carbon and is a necessary one to obtain the best results.

The lower portion is a thin-walled, fluted, hollow cylinder, made from special materials and by a special process, resulting in a quality of battery carbon which, as is the case with some natural products, cannot be obtained in this country. While the crude carbon is remarkably pure, great care is taken to free it from all injurious elements, such as iron and other foreign substances, which would be liable to produce local action. The carbon mixture is subjected to a special patented process which renders the lower portion after baking more porous than any other battery carbon ever produced.

The top portion is composed of an entirely different kind of carbon from that used in the lower portion, which, after being subjected to enormous pressure, is treated when the carbon is complete in a way which renders it impervious to the creeping tendency of the solution and action of the ammonia gas.

The upper and lower portions, after being formed, are properly baked in the kiln, after which the top of the carbon is heated red hot and plunged in hot paraffine, so that it enters into the minutest pore instead of simply collecting on the outside, as is the case with many battery carbons. The carbon made in this way has a hard dense top and a very porous lower portion. As stated above, no other carbon is made in this manner, and it is impossible to obtain the greatest advantages when a carbon is made in one piece. A one-piece carbon must necessarily have a hard top to resist the internal creeping, and in consequence has a hard lower portion which is not made porous, but simply a granulated surface. Open pores which can be plainly seen in the Samson are not produced by such a method.

A combination of manganese and pea carbon is placed inside the fluted portion and held in position by a specially prepared plug which will not fall out. It is this depolarizer and its close proximity to the exceptionally porous carbon which imparts to the battery its remarkable recuperative qualities. It can be easily renewed. After the depolarizer has been placed inside the carbon the connection made of brass heavily tinned is affixed. It is composed of large, heavy parts, and includes a safety check nut.

The result of this thorough and necessarily expensive mode of manufacture is the production of a battery carbon which has a larger surface, longer life and greater recuperative power than any other carbon element manufactured, and we guarantee the completed battery will stand more hard usage and continue its service more satisfactorily than any other open-circuit battery.

The "Special" Samson is adapted for telephone service and where the large current delivered by the regular style is not required, but the best possible recuperative ability is necessary. It has the same dimensions and voltage as the regular style. A zinc 5¼ inches long, 1 inch wide and ¼ inch thick, made of Carr metal (which is an alloy of zinc and mercury) is used with this form. It develops a current of about five amperes.

This battery is used by a number of railway companies and is preferred by some for use with telephone transmitters.

An extra heavy zinc, weighing 1 lb. (1-10 inch thick), is used extensively for operating railroad signals and for other special work. Where an excess of heavy work consumes the zinc rapidly it is economy to use this style.

Depolarizing compound is now put in a neat box, as shown in cut. The package contains the requisite amount of the material to refill one No. 2 Samson carbon, and a cork for replugging. Full directions will be found on each package.

To renew the depolarizer of the Samson carbon is a quick, easy, inexpensive and thoroughly practical operation. Carbons short-circuited from a few hours to a day do not require treating, as a rest for a few hours generally brings them back to their original strength; but after long and steady use or extended short circuits, the depolarizing properties of the manganese are expended and the Samson carbon then depends solely upon its porosity for depolarization.

There are two methods by which the hydrogen or polarizing gas may be expelled from the carbon, one by standing the carbon in boiling water and the other by heating over a Bunsen burner. If the former method is used, first remove the binding post and immerse in the water only to the point where the fluted lower portion joins the top. With the latter method the fluted portion is held over the flame for about three minutes, being careful not to heat the top so that the paraffine in it is melted. Using either method the plug which retains the depolarizer will become sufficiently softened to be easily removed, allowing the old depolarizing compound to be removed. The carbon is then refilled with depolarizing compound and the hole replugged with a cork stopple. Illustration shows method of replugging carbon.

In larger sizes of the Samson battery there are two styles, No 3 and Samson semi-dry. The former is contained in a glass jar 5x7 inches and is adapted for long-distance telephone lines and all extra heavy work. The latter is sealed in a heavy porcelain jar and is popular for all portable uses, such as gasoline launches, automobiles and marine use. No strong acids are used and it is only necessary to fill the jar with water to make it ready for immediate use.

All supply dealers furnish Samson batteries, or the manufacturers, the Electric Gas Lighting Company, Boston, Mass., can be addressed for particulars and prices.

AMERICAN CEDAR POLES IN EGYPT.

The Telephone Company of Egypt, Limited, operating a large telephone system in Egypt, has experienced great difficulty in securing a suitable pole. The climate of the country is so hot and dry that a suitable timber to use for a pole line for the transmission of an electric current does not grow, and timber imported from other countries dry-rots and becomes useless in a very short time. A certain pole imported from Sweden proved to be the most valuable so far, but its greatest life was not over four years, so the company began negotiations with cedar pole firms in the United States, with the result that arrangements have just been completed with W. C. Sterling & Son of Monroe, Mich., wholesale producers of cedar poles, ties and posts, for the shipment of 1,500 poles of the white cedar variety, Michigan grown, to Alexandria and Cairo, Egypt.

Correspondence opened between the two firms last June, but owing to the great distance and slow transportation of mail matter, arrangements were not completed until last week and the shipment of the material will begin at once.

Messrs. Sterling & Son have earned an enviable reputation as reliable dealers and claim to have made the only previous shipment of material in their line to a foreign country. Two years ago they made a large shipment to Buenos Ayres, South America, and naturally feel much elated at receiving the second foreign order. They are negotiating for the shipment of a large order for poles to Spain and Portugal, with fair prospects of success.

Oriental advices received by the steamer Victoria say that Baron Masahide of Tokio has obtained from Director Sheng of the Chinese railways, a concession for the erection of telephone lines which will connect the largest cities throughout China. The preliminary arrangements contemplate that China shall furnish the funds and the Japanese the experts and material.

TRADE NOTES.

WILLIAM ROCHE, 42 Vesey street, New York, is sending out a very attractive booklet of interest to battery users. It contains some valuable information and will be sent upon request.

THE ST. LOUIS ELECTRICAL SUPPLY COMPANY, 1118 Pine street, St. Louis, Mo., carries in stock a large quantity of telephone supplies of all kinds, especially of line material and wire.

THE SUN ELECTRIC MANUFACTURING COMPANY, West Chester, Pa., has just issued a new and very attractive catalogue, which will be sent upon request to anyone interested.

THE CHASE-SHAWMUT COMPANY, Boston, Mass., is distributing a neat pamphlet in which the merits of the Boston cable clip are set forth. This clip is simple and strong, and is adjustable for the support of aerial cables.

THE KELLOGG SWITCHBOARD & SUPPLY COMPANY, Chicago, has prepared a folder containing a special introductory offer for those who wish to install its telephone apparatus. This offer holds good until February 1, 1902.

THE HAINES & NOYES COMPANY, Chicago, manufactures a very interesting line of apartment house telephones, adapted to be mounted in connection with hall letter-boxes or for intercommunicating purposes between tenants.

THE C. A. MANUFACTURING COMPANY, Austin, Texas, is sending out a little booklet calling attention to the C. A. wood preserver, which is especially recommended for preserving poles. The company will send the booklet upon request.

THE MONARCH TELEPHONE MANUFACTURING COMPANY, Chicago, has been compelled to enlarge its factory facilities three times since it commenced business in May of last year. The company manufactures telephonic apparatus and accessories.

THE ACME ELECTRIC COMPANY, Chicago, report a steadily increasing business and will close a prosperous year. More especially has the company's business been heavy in exchange equipment and bridging apparatus. The new 1902 Acme catalogue is in press and will be mailed upon request.

FARR TELEPHONE & CONSTRUCTION SUPPLY COMPANY, Chicago, has ready for immediate mailing a very unique brass-bound hanger, number 29. The hanger has two hundred and twenty-five illustrations and is reversible. It will be sent postpaid upon request, if this publication is mentioned.

THE KEELYN TELEPHONE MANUFACTURING COMPANY, Chicago, is sending to the trade a unique line of cards which it designates as salesmen. A, B and C have been issued, as well as an allegorical card showing the old century and the new. These cards will be mailed postpaid upon request.

THE MANHATTAN ELECTRIC SUPPLY COMPANY, New York and Chicago, is a large manufacturer of telephone apparatus. This company was one of the first in this field and has built up a very extensive business. Among its many other specialties is the Mesco battery, which is particularly well adapted for telephone work.

THE CHICAGO TELEPHONE SUPPLY COMPANY, Chicago, have issued a very attractive little booklet, entitled, "The Chicago Method." It treats of the construction of bridging generators and contains a great deal of interesting matter. It is printed in colors and will be sent free to any address, accompanied by a color card entitled, "One Reason Why."

JOHNSTON & DEAN, St. Louis, Mo., have issued a new catalogue of tools and materials for telephone, telegraph and electric companies. The catalogue contains a great deal of practical information, is fully illustrated and should be read by every live telephone man. The book will be sent free to those mentioning this publication.

THE D. A. KUSEL TELEPHONE & ELECTRIC MANUFACTURING COMPANY, St. Louis, Mo., is a maker of telephone supplies, and in its 1901 catalogue describes a number of them at length. It describes all the details of exchange and intercommunicating systems and supplies for such installations, as well as a variety of line material and appliances.

THE STERLING ELECTRIC COMPANY of Lafayette, Ind., is running its factory twenty-four hours a day and employing 400 people. The factory is very complete and has recently been quadrupled in size and orders are still piling up. General Manager Doolittle states that the fine new telephone exchange his company is equipping for Toledo, Ohio, will be in running order by next April.

THE HIPWELL MANUFACTURING COMPANY, Allegheny, Pa., manufactures long-distance telephone and telephone supplies of all kinds, among which may be listed ringers and bridging generators, telephone sets, both of wall pattern and desk pattern, switchboards and parts of switchboards, intercommunicating telephones, both for desk and wall use, receivers, transmitters, induction coils, and the other details which go to make up telephones.

THE INTERNATIONAL TELEPHONE MANUFACTURING COMPANY, Chicago, has taken the third, fourth and fifth floors of the B. F. Sturtevant building, Harrison and Clinton streets, Chicago. The company is equipping its plant with the latest and most improved machinery and making the special tools necessary for the manufacture of its complete line of central energy and generator call public and private telephone apparatus. The company will be in position to handle any size contract within the next few months.

THE CENTRAL ELECTRIC COMPANY, Chicago, Ill., has issued a price list especially adapted for those who wish to secure telephones and telephone supplies as quickly as possible. A large amount of data regarding these supplies is contained in this catalogue, which will be sent to anyone upon application. The company desires to call attention to the D. & W. telephone protector, which embodies a lightning arrester, line fuses and sneak coils, upon which a descriptive bulletin has been prepared that will be mailed to anyone who is interested in this material.

THE CHICAGO TELEPHONE SUPPLY COMPANY, Chicago, Ill., has recently published a booklet, entitled "Crops, Comfort and Telephones," intended to give information to those dwelling in the country concerning the value and importance of telephone service for farmers, and especially to show the importance of bridging telephones for such work. The booklet is a beautiful example of the printers' and engravers' art, and contains matter of the highest interest to those who are in any way concerned with farmers' exchange or neighborhood co-operative telephone line business.

THE CLARK AUTOMATIC TELEPHONE SWITCHBOARD COMPANY, Providence, R. I., manufactures an automatic intercommunicating telephone system which is also useful for local exchange work. The instrument is operated by means of switches of the step-by-step automatic type, controlled by dials which are handled by the telephone users. The system has been installed in a large number of buildings, such as offices, factories, etc., and in a number of towns, and has given entire satisfaction. The Clark switches are said to be less complicated than the majority of automatic telephone switches, the overall dimensions of the device being 4 inches square by 3¾ inches high for a system of seventy-five telephones. The company has recently brought out a catalogue very fully explaining and illustrating its product, which will be mailed upon request.

THE CENTURY TELEPHONE CONSTRUCTION COMPANY, Cleveland, Ohio, has brought out its new catalogue, No. 30, concerning switchboards. The catalogue contains a great deal of information of a practical and interesting character and several illustrations of switchboard apparatus of interest. The company has lately organized, built and equipped a large number of exchanges through western New York and northern Pennsylvania, making for them the switchboards, telephone and other accessory apparatus. The central battery system is used, with all of the signals of the automatic electric lamp type. The relays in use both for the lines and for controlling the supervisory purposes are exceedingly simple. The open multiple method of wiring is used in the construction of the multiple switchboards, and it is claimed that it possesses great advantages.

MATHIAS KLEIN & SON, Chicago, manufacturers of linemen's and construction tools, and iron specialties for telephone, telegraph and electrical work, have been forced to make an extensive addition to their present facilities, owing to the greatly increased demand for their products. The firm has erected a four-story building at 89 West Van Buren street, adjoining its present location. This addition will give the firm nearly 8,000 square feet more space than it now has at its command. Mathias Klein began the manufacture of tools in 1857, at which time his output was consumed by the Illinois & Mississippi Telegraph Company. This company was merged into the Western Union Telegraph Company shortly after 1861, and Messrs. Klein & Son take pride in saying that they have been manufacturing tools for this company ever since. Much of the success of this firm is due to the able management of Mr. John M. Klein.

THE AMERICAN ELECTRIC FUSE COMPANY, Chicago and New York, has recently opened commodious offices and stock rooms in the Empire building, Atlanta, Ga., for the convenience of the company's southern trade. A complete stock of fuse wire, telephone protectors, wire joints, cable insulators and other American specialties will be carried in stock, from which immediate shipments can be made to any part of the south. Mr. Price E. Allison, who has represented the company as a traveling salesman, has charge of the southern office.

The American Electric Fuse Company's business has increased over 200 per cent during the past year, the company now being one of the largest manufacturers of telephone protective apparatus and electrical specialties in the world. The principal factory of the company is at Adrian, Mich., where employment is given to over two hundred men. Within the past six months the company has purchased all the patent rights of the well known Rolfe protectors, the sale of which has been so heavy the company has been compelled to run its factory nights for the past two months in order to keep up with the demand. With the company's efficient managers in Chicago, New York and Atlanta the company is certain of its share of prosperity during 1902.

THE HAINES & NOYES COMPANY, manufacturers of guaranteed telephone apparatus for every possible use, 118-132 West Jackson boulevard, Chicago, has during the past month closed up the following large contracts through their private telephone plant department: The Manistee Iron Works, Manistee, Mich.; Story & Clark Piano Company, Grand Haven, Mich.; David C. Cook Publishing Company, Elgin, Ill.; College of Physicians and Surgeons, Chicago; Rush Medical College, Chicago; Wesley Hospital, Chicago; Evanston Hospital, Evanston, Ill.; St. Anne's Hospital, Chicago; Elmes Engineering Works, Chicago; Tampa Electric Street Railway Company, Tampa, Fla.; Houghton County Street Railway Company, Hancock,

Mich.; Blue Hill Street Railway Company, Milton, Mass. The company has also supplied Armour & Co. of Chicago with a large number of telephones, besides replacing a number of telephones that were formerly in use there. Through its agents, the Haines & Noyes Company has also equipped a large number of business houses in Lynn, Mass., Philadelphia, Pittsburg, Louisville, Boston, Kansas City, St. Paul, San Francisco, Los Angeles, etc. Besides these large plants, this company has equipped a number of private residences with telephone systems, as well as numerous apartment buildings throughout America.

A B C OF THE TELEPHONE. By James E. Homans, A. M. Published by Theo. Audel & Co., New York. Bound in cloth. Price, $1.

This book contains about 330 pages of matter of great interest to workers in the telephone field. It is profusely illustrated, which aids in making clear the construction and operation of telephonic apparatus. While giving a distinct idea of the contrivances employed in practical telephony, together with points on construction, this book enters into technical details no more than is positively necessary to insure an understanding of the subject. It is intended for the use of all persons desirous of obtaining an adequate idea of the practical operation of the telephone industry; how the impulses of the voice are transmitted by the electric current; how telephonic connection between two lines is made at the exchange, together with the various devices there employed for expediting the operation; and the most approved methods of constructing telephone lines and insuring thorough conduction of the telephonic currents. The subject of private intercommunicating telephone systems is also fully treated, being illustrated with diagrams of wiring, containing descriptions of the most practical switching devices, and numerous representations of specially constructed apparatus.

PERSONALS.

MR. CARL SEYLER, formerly with the McIntosh-Huntington Company, Cleveland, Ohio, has accepted a position with Messrs. Hubbard & Co., Pittsburg, Pa., having charge of the company's telephone department.

MR. FRANK B. COOK, president of the Sterling Electric Company, Lafayette, Ind., is the father of an eight-pound boy, born November 29. Mr. Cook has received the congratulations of his many friends and is proud of the new acquisition to the family.

MR. F. E. BELL, Desplaines, Ill., has secured a franchise and will build an exchange at New Decatur, Ala. The company will commence with about three hundred subscribers and be known as the Liberal Telephone Company. Associated with Mr. Bell in the enterprise is his brother, W. J. Bell, of Baraboo, Wis. These gentlemen have built a number of successful Independent exchanges in different sections of the country.

SLOT TELEPHONES FOR CHICAGO.

Telephoning in Chicago is becoming a nickel-in-the-slot habit. Thousands of these instruments have been installed. Movable telephones are being installed in leading restaurants, with plugs beside every table, enabling customers to use the apparatus while eating their meals.

"Six months ago Chicago had 30,000 telephones. To-day she has 40,000, and within the next two years we will install instruments that will bring the total number of subscribers up to 100,000." This is the way John I. Sabin, president of the Chicago Telephone Company, tells the story of the enormous increase in the number of telephone subscribers. The demand, he says, is beyond the resources of the corporation. The directors lately decided to issue $3,000,000 additional stock in the coming year, making a total increase in 12 months of $5,000,000.

Several thousand applications for the service are now in the hands of the installation department, every branch of the working force has been increased more than 20 per cent, and all canvassers have been taken out of the field.

One interesting feature has been the opening of what is practically a school for new operators, who are given places at switchboards as soon as they pass the tests required.

Of the 10,000 new subscribers secured during the last six months 9,000 are persons who have never before used the telephone. The firms that have always been large users are demanding the installation of individual switchboards and internal service, a system that within the last few weeks has been obtained by several hotels.

NEW KELLOGG APPARATUS.

One of the latest types of switchboards made by the Kellogg Switchboard & Supply Company is shown herewith. The entire front sides and back of the cabinet are of quartered oak, neatly paneled and beautifully polished, which presents a very striking appearance.

The front and rear panels are readily removable, being held in place by flush ring catches of highly polished brass. This construction makes access to all apparatus a very simple matter. The keyshelf is three-ply hinged. The plug shelf is covered with heavy belt leather to prevent wear of the plugs. The foot-rail is of brass and highly polished, which adds much to the general attractiveness of the board.

In designing this board it was the purpose of the company to produce one that would, by means of its superior construction and latest types of devices, overcome a number of objectionable features found in most boards, and at the same time make it very rapid in operation. It has a capacity of 300 magneto lines, and is equipped with the Kellogg combined mechanically self-restoring drop and jack, and is provided with lamp transfers. In each end position is shown, just beneath the drops, the lamp transfers, five in number, with a capacity of ten in each position. These are operated by 10 cells of Fuller battery. The object of these lamp transfers is to make rapid connections between subscribers whose lines terminate in a position not within easy reaching distance of the operator who receives the call. As an illustration, a subscriber asks the operator at the right for a number in the position on her extreme left; she immediately plugs into the lamp transfer, as shown in this cut, which lights her lamp, and the corresponding lamp in the position where the connection is desired; this being a signal for the second operator, she immediately plugs into the jack corresponding to this lamp, as shown, which being done extinguishes both lamps, and completes the circuit between the two operators, thus enabling the first operator to give the second one the subscriber's number, who makes the desired connection. After the conversation has ended, the subscriber rings off, operating clearing out drops in the position, and then the operator pulls out both plugs. This operation illuminates the lamps in both positions, thus telling the first operator that the conversation has ended and connections should be taken down, which being done, both lamps are extinguished.

Each position is separated by a quartered oak panel. A key is mounted on the two middle and left hand end panels, which are so arranged that only one generator, either hand or power, can be connected in at any one time. The fourth switch, as shown on the extreme right, controls the night bell alarm, the object of which is to ring a bell whenever a drop falls, thus calling the attention of the operator.

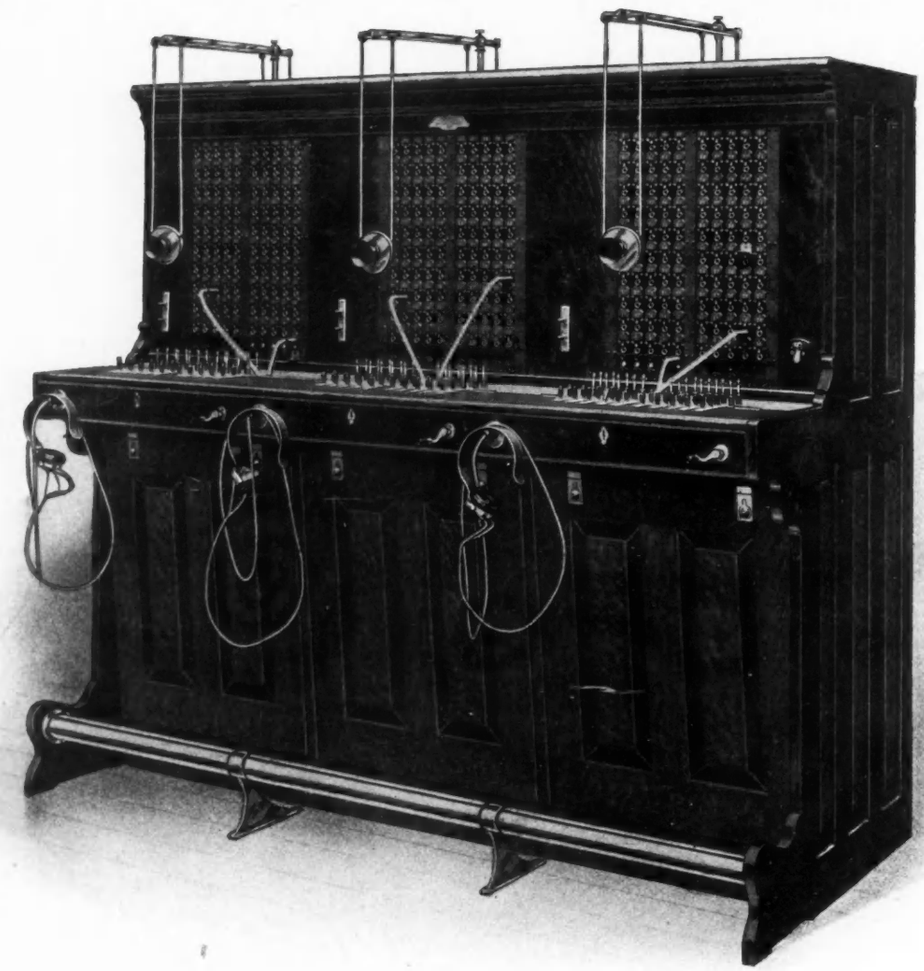
The drops are of the tubular type, which give the maximum electrical and mechanical efficiency. The jack and drop are rigidly connected together by a metallic mounting strip, which makes their adjustment permanent. Any single drop and jack, or any part of one, can be readily

removed from the board for repairs without the use of the soldering iron. The drop is cut out during conversation, presenting an absolutely free talking circuit. The jacks and drops are mounted five per strip, and fastened to a structural steel frame, with machine screws. The front and back is of polished hard rubber reinforced by heavy brass, thus giving a neat appearance combined with good insulation, and entire freedom from warping. The clearing out drops are of the tubular type, high wound, and bridged across the cord circuit. All the drops and jacks are mounted in a structural steel framework. The combined ringing and listening keys are very simple and well constructed. The springs are of German silver with 99 per cent pure platinum contacts.

Each key is so arranged that the operator can ring out on either answering or connecting cord. The plugs and cords are the same as used on large multiple boards, and are warranted to give satisfaction. The plugs are reinforced by a steel-pointed tip. The board is wired on the full metallic plan, and is consequently readily adapted to common return or grounded circuits. The operator's transmitter is the well-known Kellogg type, adapted for long distance work, suspended from a graceful nickel-plated arm, which has two adjustments, one for height, and one for distance from the board. The head telephone is provided with a six-foot green silk cord, terminating in a plug, which may be inserted in the cut-in-jack in the face of the keyboard, as shown in the cut. This cut-in-jack is so arranged that when the operator's plug is withdrawn, the circuit of the operator's battery is automatically opened, as is also the operator's talking circuit. This prevents the wasting of the operator's battery, when the board is not in use.

The operator's hand generator is one of the four magnet type, and mounted in the rear of the board, where it is readily accessible.

The cabling throughout the switchboard is done with silk and cotton insulated wire. All joints are soldered to their respective terminals without the use of any acid. All the line drops and jacks may be cabled down to a connecting rack at the bottom of the board and within the closing rear panels, or may be brought out direct in any length of cable, as desired.



LATE TYPE KELLOGG SWITCHBOARD & SUPPLY COMPANY SWITCHBOARD.

KEEPING DUST FROM TELEPHONES.

Dust in telephone operating rooms forms a serious obstacle to smooth proceedings, settling in the connections of the switchboard and making them imperfect. The Twin City Telephone Company of St. Paul, Minn., has decided to try a remedy. It is installing in its new exchange building a system of heating and ventilation that, it is expected, will prove a profitable investment.

The building will be heated by hot air driven into the operating room by huge fans located in the basement. Before entering the room, this air will be forced through a spray of water which will remove all dust and other impurities.

Another feature of the new apparatus is that in summer the air, by percolating through the spray of cool water, will be cooled, and the temperature of the operating room will at all times be comfortably pleasant.

THE CONSTRUCTION OF A SMALL EXCHANGE.

BY W. H. CRUMB.

The probable number of subscribers to a telephone exchange, in a given town, may be very accurately estimated from a knowledge of the number of subscribers at other towns of approximately the same size, under approximately similar conditions. The telephonic development (ratio, in per cent, of the number of telephone subscribers to the number of inhabitants in a given locality) is easily obtainable from several operating exchanges.

Thirty Independent exchanges in towns varying from 2,000 to 5,000 inhabitants, show an average development of 6.8 per cent or 340 subscribers for the town of 5,000. Fourteen of the towns have a development above the average, ranging from 7 per cent to 12 per cent. Bakersfield, Cal., which has a population of 4,836 has 1,005 Bell telephones in service, which shows a development of 20.8 per cent. Ten Independent exchanges, in towns of less than 2,000 inhabitants, each having a number of farmers' lines, have an average of 200 subscribers each. At a majority of the exchanges mentioned the development could be considerably increased. From the above it will be seen that one should not estimate on an ultimate development of less than 10 per cent, for with moderate rates, good service, and plenty of effort on the part of the management to secure new subscribers and serve their interests, this can easily be accomplished.

For the purpose of this article, a small telephone exchange is defined as an exchange, the ultimate capacity of which will not exceed 450 or 500 subscribers' lines. This will usually be found to be sufficiently large for towns of 5,000 inhabitants or less.

Having estimated the ultimate capacity of the exchange, and secured contracts from a number of subscribers, a good map of the town should be secured, upon which, locate by dots or figures, the present and prospective subscribers. The plan, for the construction of the pole lines, should always be made so as to best serve the necessities for the ultimate capacity of the exchange. With this in view, as little of the construction work as is desired may be done at the start, but the plant will be designed along the proper lines for future extensions.

The construction of a telephone exchange, may be divided into three separate parts, as follows: Exchange equipment, wire plant, and sub-station equipment.

The exchange equipment consists of the switchboard, and all the necessary auxilliary apparatus located in the central office.

The wire plant consists of pole lines, cables, wire and all that portion of the plant from the protectors in the central office, to the end of the subscriber's line, which is attached to his buildings.

The sub-station equipment consists of the subscriber's telephone, and all apparatus and wiring used in connection therewith, located within the subscriber's premises.

In deciding upon a location for a central office two important questions are involved, viz., the most economical location from a construction standpoint, and the best location from a business standpoint. The former is easily found by taking the map which has marked upon it the present and prospective subscribers, and drawing across it a horizontal line which will equally divide the number of prospective subscribers, a vertical line is then drawn in a like manner and the intersection of these lines is called the center of distribution. The center of distribution is that point from which the average length of all subscribers' lines is a minimum. The cost for construction of wire plant is cheapest when the central office is located at the center of distribution.

It will usually be found that the center of distribution is located in the business section of the town, and that it is approximately well located from a business standpoint. It occasionally happens, however, that the center of distribution will be located some distance from the business district, in which case it must be decided whether the advantage of having the central office at another point will compensate for the interest and maintenance of the increased investment necessary.

In many small towns it has been found advantageous to locate the central office in a residence or drug store, where the service at night and during slack times of the day can be attended to by someone who has other duties to perform, thereby economizing in the operating expense in an amount sufficient to justify considerable additional construction expense.

THE SPECTOGRAPH.

The Paris correspondent of a New York daily sends the following cablegram from Paris:

Dr. Sylvestre, the inventor who claims to have discovered how to see by telephone, has just described his remarkable discovery, which he declares was a matter of chance. He said:

"There is no reason why, as soon as telephonic cables are established between Paris and New York, we should not see our friends there as easily as I see you.

"I have already seen the Marseilles Telephone Exchange from this room by means of my apparatus, and I have chatted by telephone with M. Mougeot, the French Postmaster-General, watched his astonishment and described his appearance, his clothes, his office as we talked.

"I cannot work my apparatus for you yet, because I am in treaty with the French postoffice people, and the method is so simple that if I showed it to you you could go away and make an apparatus just like it.

"I may well confess I do not altogether understand my own invention. I discovered it quite by accident, although it acts quite perfectly and shows colors of all kinds with absolute faithfulness and very vividly. I am not scientist enough to explain how or why it acts exactly as it does.

"Six weeks ago I was in my laboratory enameling some teeth and was sitting over a big stove. There was no light in the room excepting what the stove gave. The walls of my laboratory are white. My job was a long and wearisome one, and as we have a 'theaterphone' at my flat, I had myself connected with the opera and was listening to Griseldi's while I waited for the enamel to melt.

"Suddenly I noticed colors and figures on the wall in front of me. I put down the theaterphone.' They disappeared.

"I took it up again and again I saw the figures, and this time much more distinctly. Then I both heard and watched the whole act of the opera sitting in my chair before the stove.

"The spectograph was invented. I had found out how to see by telephone. For a fortnight I worked over my invention day and night. Then on the 21st of last month, my apparatus being perfected, I wrote M. Mougeot, the French Postmaster-General, and asked him to receive me. I have seen him several times. I am now in treaty with the French government for a 'cession' of my invention, for which I want $5,000,000.

"I have tried the apparatus several times since under all sorts of circumstances and it never failed me. Space is annihilated by the spectograph, and the thing itself is so absurdly simply that the apparatus will only cost about $3.75.

"My invention practically does away with telegrams. Put a written communication in front of the looking-glass at the London end of a wire and your correspondent in France will see it quite distinctly at his end.

"As soon as my contract with the French government for $5,000,000 is signed I mean to give an immense show in the Galerie des Jardin, Champs des Mars, to all who care to come. There on an enormous sheet I will show what my apparatus will do."

Dr. Sylvestre showed a small circular mirror, with a hole in the center, into which is screwed a tiny electric light of 1.10 candle power. This is fixed to a telephone's microphonic plate by an India rubber band, a pencil-like instrument connecting the current with the apparatus.

NEW FEATURES IN INDEPENDENT TELEPHONE EQUIPMENT.

For the past few years there has been such a remarkable development in Independent telephony and such constant improvements in the various systems, that many minor changes have never been brought to the notice of the general public.

A careful study of the rapid progress in this line and the results attained in the numerous changes will clearly show that the general tendency and aim in the improvements has been to lessen and simplify, to the greatest extent possible, the work and attention necessary for the user to operate the system and to centralize as much as can be the sources of energy and parts that are subject to deterioration from their use. Most of the rigid lines of demarcation which only a few years ago separated the opinion of the engineers on these points have been considerably softened and many have been entirely obliterated.

While many different makes of systems along these lines have been produced, which from their similarity in general appearances and working would to many inexperienced persons fail to reveal any divergency beyond unimportant details, and be considered at the hightest point of perfection, yet from an electrical and mechanical point of view there has still been considerable possibility of development, particularly in the construction of the detail parts of the equipment, to secure the most durable and economical system when installed and the most convenient and efficient service with the least possible trouble and interruption.

Some of the most advanced steps in this direction are clearly shown in the apparatus recently evolved by the International Telephone Manufacturing Company, Chicago, and a brief consideration of some of the new features embodied in this equipment may be of interest.

The transmitter shown in Fig. 1 is claimed to be the most efficient on the market. The carbon cup is of a light metal receptacle with its wall properly insulated and is mounted on a small stud securely fastened to the center of the diaphragm. It contains the front electrode and forms the chamber for the granular carbon. The back electrode is supported by a bridge and so mounted that it can be readily adjusted, and when set in its proper position it is firmly clamped and locked by a set screw in the collar at the center of the bridge. The granular carbon is held in its chamber by a small mica ring between the edge of the back electrode and the walls of the cap to which it is clamped by a small set rim, thus avoiding the use of felt or plush or other material subject to becoming compressed and unserviceable. The diaphragm and front electrode is insulated from the frame of the transmitter. The diaphragm is firmly held in position by two forked springs clamping it at four points. An insulated wire leading from the front electrode is terminated at a clip on a small rubber block mounted on one end of the bridge. A similar terminal is provided on the bridge for the back electrode. From these terminals the circuit is completed to the induction coil by a double conductor cord, thus avoiding the use of the transmitter arm and frame as one side of the circuit. The bridge and all working parts of the transmitter are mounted and securely fastened on a strongly built cast front piece and are inclosed with a heavy stamped brass bell-shaped back piece. The soft rubber rim insulating the diaphragm being firmly clamped to the front of the frame, and the carbon receptacle being entirely sealed, leaves it impossible for moisture to enter.

The receiver shown in Fig. 2 is claimed to combine the most practical ideas and essential points on an instrument of this kind. It is of the double pole horseshoe magnet type and is constructed so the magnets may be readily adjusted toward or from the diaphragm, and so it can be conveniently locked or unlocked with a screwdriver at the set screws projecting through the side of the receiver head inside the rubber shell. The diaphragm is securely clamped to the metal head by a brass ring, thus avoiding any possibility of becoming out of adjustment from the variation of the contraction and expansion between metal and a rubber shell. This set ring is constructed with a disc or plate suspended in its center to form a protection to the diapragm at the hole in the receiver cap. All metal parts of the receiver are strongly built and self-contained and are completely inclosed in a hard rubber shell and cap. The cord enters the top of the shell and is terminated inside and fastened by a hook to relieve the connection from any strain.

Fig. 3 shows an individual generator call local battery toll line telephone. The transmitter arm is provided with a false base on which it is hinged and is fastened with a lock and key. The induction coil and all its terminals are mounted on the false base, leaving all parts readily accessible for testing when opened, and when the arm is closed no screws, terminals or wires are exposed. The arm is hollow. Through it passes the two conductor cords from the transmitter. It is made with a large surface hinge on its base for lowering and raising the arm and held in position by a heavy nickel-plated brass bolt and nut of neat design.

The magneto box is provided with a false removable bottom on which are mounted the generator, switch and terminals. The switch, shown in Fig. 4, is self-contained, with all springs provided with platinum points and with the hook forming no part of the circuit. The generator crank shaft is constructed with an insulated head, perfectly insulating the crank from the generator. The polarized ringer shown in Fig. 5 is provided with an adjustment for the armature and also the bell hammer. The yoke to which the armature is pivoted is permanently held on one post and fastened between two adjustable thumb nuts at the other post so the armature may be readily adjusted. The bell hammer pin is fastened at the armature in a threaded stud so the pin can be lengthened or shortened to correspond with the thickness of the board on which the ringer is mounted, so the ball may be adjusted to strike the gongs properly to give the clearest tone. The lightning arrester, a carbon disc protector with ground plate and the line terminals are mounted at the top in the inside of the magneto box. The insulated line wires pass through the top of the magneto box and terminate at the line posts inside. In this telephone, as well as all of the company's wall and desk instruments for both generator call and central energy systems, there are no exposed metal parts that form any part of a circuit at any time. It is said that this feature has never been carried out in any other system.

Fig. 6 shows the regular public exchange central energy wall instrument. The carbon disc lightning arrester and line terminals are mounted in a neat box at the top, which also serves as a holder for a card of directions and telephone number. The switch, ringer and condenser are mounted under the shelf. It is so that when the shelf is raised the front with the ringer turn out on a pair of hinges and bring all parts in plain view for convenient inspection and testing.

The desk telephone, shown in Fig. 7, is a neatly designed, strongly built instrument. Its pedestal and head is of heavily nickel-plated cast brass, making it very rigid. The platinum contact switch springs are mounted in a hard rubber head and with the hook restoring spring are entirely inclosed. The induction coil and all connections are mounted in the base of the instrument.

Fig. 8 shows a combined self-restoring drop and spring jack for generator call exchange switchboards. The shutter when unlatched falls down and lowers the small restorer and at the same time presses back the pin which closes the night bell circuit springs. These springs are mounted on the rear of the drop, are provided with a point and plate contact and form a slight sliding connection. When the plug is inserted it raises the restorer which throws back the shutter. The drop is so constructed that the coil

can be readily taken out from the front of the board without unsoldering a connection and replaced. It is set into a socket forming a connection like a plug and jack. The shutter is also easily removed from the coil, so when numbered the same shutter may be used when a coil is changed and that the coil only can be returned for repair. The drops are mounted singly from the front of the board in rows of twenty. The plug shown in Fig. 9 is very neat in its design and construction. It is the plug that is used on this company's generator call board, as well as its central energy trunking and multiple switchboards. The shell is slipped on from the tip and held in position by a small set ring, thus avoiding the use of a set screw through the handle.

Fig. 10 shows a bank of ten lamp signals. The lamps are placed in an opaque tube. This confines the light to the one number only when a signal is given. An opalescent glass jewel is mounted at the end of the tube. The tube with lamp is inserted into the lamp jack from the front. The lamp jack is provided with a point contact to prevent corroding between the jack spring and lamp base, and so the lamp may be easily removed without breaking.

Fig. 11 shows a strip of multiple spring jacks. The multiple jacks are mounted 3/8-inch centers (in strips of twenty). The frame piece is of a veneer of a brass bar between two strips of insulating rubber. This makes the banks of jacks very strong and rigid. The brass bar is extended and forms a shoulder for fastening the banks to the iron switchboard frame. The springs are mounted flat upon a heavy rubber back piece. They are firmly clamped with the heavy rubber insulating bar between the tip and sleeve springs of each jack.

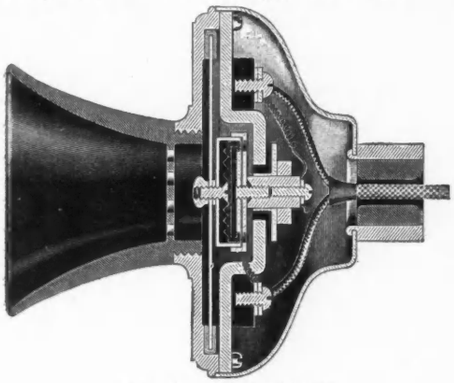


FIG. 1. TRANSMITTER.

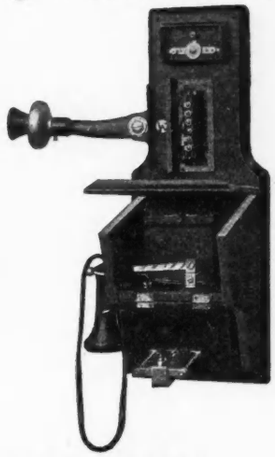


FIG. 6. CENTRAL ENERGY WALL TELEPHONE.

FIG. 7. DESK TELEPHONE.

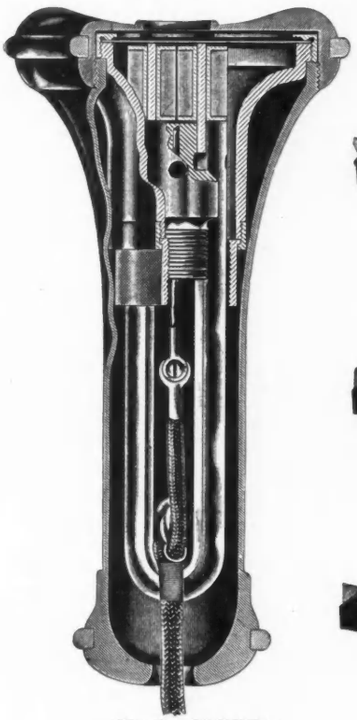


FIG. 2. RECEIVER.

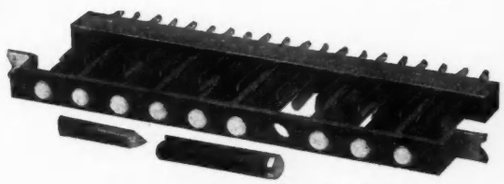


FIG. 10. BANK OF LAMP SIGNALS.

FIG. 11. MULTIPLE SPRING JACKS.

FIG. 3. TOLL LINE TELEPHONE.

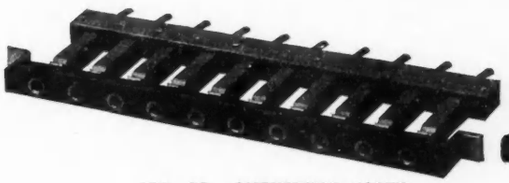


FIG. 12. ANSWERING JACKS.

FIG. 9. PLUG.

FIG. 8. SELF-RESTORING DROP.

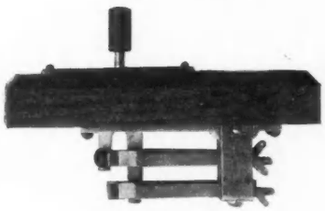


FIG. 13. KEY.

FIG. 4. SWITCH.

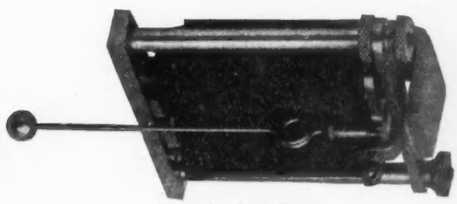


FIG. 5. RINGER.

INTERNATIONAL TELEPHONE MANU FACTURING COMPANY'S APPARATUS.

The answering jacks, shown in Fig. 12, for multiple boards and jacks for transfer switchboards, are mounted similar to the multiple jacks with ten on a strip.

The ringing and listening key is shown in Fig. 13. It is constructed with one set of springs above the other, enabling the use of long springs and leaving the key short and compact. The cam lever is forked with one leg reaching to the first set of springs and arranged that the springs are opened from the front, and with the other leg passing through to the second set of springs, which are so arranged that they are opened from the rear. The springs are of the best quality spring German silver and are provided with platinum contact. The terminals of the springs are all at one end of the key, so it requires but one key cable in its wiring.

The springs are mounted in a rubber block and firmly clamped to always hold them in their proper position. The block is securely fastened to a brass base for mounting.

All these parts shown, constituting the essential apparatus for the equipment of any size multiple or trunking, central energy or generator call exchange and toll line systems, and the new features described, it is said, are fully protected by patents that have been allowed to this company. It may be said that the special features contained, especially the constructing a telephone with no exposed metal parts forming any part of the circuit at any time, and with all binding posts and terminal screws and all wiring concealed; with the transmitter arm hinged on a false base to avoid unscrewing it from the back board and splicing the wires to make a test; with the banks of spring jacks made with a front piece of a veneer of rubber and brass to make it strong and rigid; with the placing of the lamps in opaque tube to concentrate all light to its own line signal; with the key constructed to allow the use of long springs without taking up too much space on the key shelf, all mark an advancement in telephone equipment.

MEASURING VIBRATION OF A TELEPHONE TRANSMITTER.

A painstaking inventor has devised an apparatus for measuring the vibration of a telephone transmitter by means of a ray of light reflected from a small mirror cemented to a steel pinion set in watch jewels, says The Engineer. To the center of the diaphragm is soldered a needle which presses on a steel arm. This arm is perpendicular to the pinion and in the plane of the mirror. The slightest vibration is transmitted through the needle and arm to the mirror, causing it to oscillate and thus deflect the beam of light. In an experiment a diaphragm excursion of one three-thousandth of an inch deflected the spot of light on a screen twenty-five feet away, two inches. The ticking of a watch gave noticeable deflections, and loud sounds produced deflections of two feet.

AN ACCOMMODATING OPERATOR.

One of the latest stories concerning the telephone girl comes from a Bell exchange in Central Illinois. A subscriber called for No. 126, which instrument was located at the home of an intimate friend. The answer came in an unfamiliar voice and the subscriber discovered that she had been connected with No. 125. She rang off and called up central again, and the conversation that followed was something like this:

"Say, central, you gave me the wrong number. I called for 126 and you gave me 125."

"I know it," answered the operator, "but it was the best I could do. No. 126 was busy."

"Your paper is all right. It's worth three times the price.

Gastonia Telephone Co.,
Gastonia, N. C."

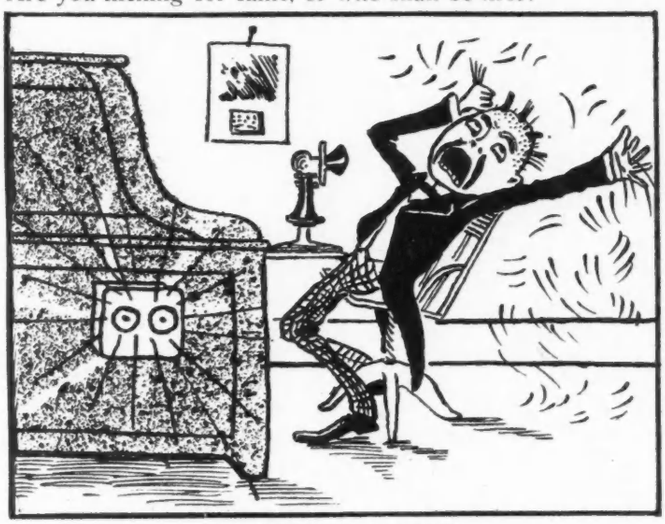
ELECTROLYTIC TELEPHONOGRAPHS.

As every loose contact, and also any variable current, even, that passes through the electric arc, may be made to speak, and since Poulsen and Petersen have succeeded in obtaining magnetic telephonic records available for reproduction, it is not surprising that we should hear of electrolytic telephonographs, says Engineering, London. The idea occurred simultaneously to Prof. Nernst, of Gottingen, and to one of his students, R. von Lieben, and the latter is continuing the researches, so far with rather indifferent practical success. Yet the subject is in itself interesting. The first arrangement used was a direct adaptation of the Petersen device to electrolysis. An endless belt of platinum is moved by an electric motor over two pulleys. From below presses gently against the belt a little wedge of wood, placed in a small electrolytic cell. The transmitting microphone is placed in the primary of a transformer, whose circuit comprises five accumulators. The electrolytic cell, with its one electrode, and the platinum belt and battery belong to the secondary circuit, which is closed by means of a switch, for receiving records, and joined to a telephone for reproduction. The leading idea was that the local electrolytic polarization, impressed upon the moving belt, could be utilized in the same way as the magnetic polarization in the Poulsen experiments. This proved, indeed, perfectly possible, and sometimes the electrolytic records could be used for several hundred repetitions. But the effect is not purely an electrolytic one, and its nature remains to be established. For the sounds became the clearer —within limits, of course—the stronger the constant current supplied by the battery, which, as we mentioned, is inserted in the secondary circuit. These constant currents would be superimposed upon the polarization currents, and it is not directly clear why their strength should intensify the telephone sounds, as the telephone responds only to the current fluctuations. There might be a contact resistence effect increasing with the current strength; but the polarization of the different experiments was of a varied nature, as will be seen. The investigators incline to the belief that the strong microphone currents produce a kind of mechanical loosening of the respective portions of the metallic belts, and this effect alters the polarization capacity; the friction between the parts would thus be varied, a circumstance to which Edison and others have long since drawn attention. R. von Lieben modified the arrangement as follows: Instead of the platinum belt, which gave trouble by bending, he used a copper disk, 2 millimeters thick, 450 millimeters in diameter, placed between two iron disks, and turning between centers, which served as conductors. The speed could be varied by employing a pulley resting edgeways on the disk.

The copper rim, the essential part of the device, is carefully turned and polished. A wooden wedge, with an edge about 0.5 millimeter thick and 0.75 millimeter broad, bears against the rim. As electrolyte there was employed copper or zinc sulphate, acid, neutral, or alkaline; the alkaline solutions, especially the zinc sulphate to which caustic potash was added, answered much better than the copper solution, but the zinc hydrate gradually clogged the wedge; wiping, however, cured the trouble. In these cases copper or zinc, or both was deposited on the copper rim. In other experiments the rim was first silvered, and a small silver electrode was placed in the wedge cell, and silver cyanide employed as electrolyte; in others, again, the electrode was platinum, the electrode iodide of potassium. The deposits on the rim consisted of silver, hydrogen or oxygen. The noises accompanying the gas generation disturbed the reproduction of speech, and, on the whole, the experiments were more successful when the copper disk, with its rim of copper or silver, was made the cathode than when it formed the anode.

THE LAMENT OF THE TELEPHONE MANAGER WHO USES CHEAP APPARATUS.

Frowning, the manager, complained him sore,
That complaints of subscribers, restrained him.
Robbed him of slumber, robbed him of rest,
From the North and the East, the South and the West:
The butcher, the barber, the broker, the grocer,
Over and over, and over and over.
Nine a. m., ten p. m., twelve or seven,
Nothing but kicks are heard under heaven.
How can I sleep?
Kick if you will, complain if you must,
Ring off and be done, for a man must sleep.
Are you kicking for fame, or who shall be first?



THE TELEPHONE MANAGER.

Each day is the same, yet—the last is the worst,
And my life is accursed with your silly outbursts;
Of idiotic complaints, kicking and howling,
By day and by night, while all honest men
Should be working or sleeping;
Lord! what a din.
Is your bill too high, your service slow,
You can't hear others, or they can't hear you,
Does your line cut-out, does the telephone shake,
Is your zinc eaten off, does your carbon cake,
Does your battery leak, is the crank broken off,
Is condenser short, does the transmitter squeak?
Tell it out and be done, for a man must sleep.

BIG COMPANY FORMED.

The Automatic Electric Company of Chicago has been incorporated with a capital of $2,000,000. This company has secured the manufacturing rights for the United States of the Strowger Automatic Telephone Exchange and its manufacturing plant in Chicago.

The interests back of it are the same people who control the Illinois Telephone & Telegraph Company, which is preparing to compete with the Chicago Telephone Company.

The incorporators of the new company are Edwin W. Gearhart, James C. Law and Albert G. Wheeler, Jr. They represent Clarence D. Simpson, Thomas H. Watkins of Scranton, Pa., Charles B. Eddy of New Mexico and J. B. Russell & Co., bankers, of Scranton, New York and Chicago. These people recently bought the $5,000,000 bond issue of the Illinois Telephone & Telegraph Company.

The Illinois Telephone & Telegraph Company will install telephones in Chicago on the same plan as the gas company furnishes gas to its consumers. The telephones will be placed in offices and residences without charge to the tenants, except as they have use for them. By this method the company expects to be able to install a system in this city of at least 100,000 telephones.

A guarantee will be given to each patron that the cost a year shall not exceed $85 for business and $50 for residence instruments.

The Automatic switchboard has been installed and used for several years at Augusta, Ga., Princeton, N. J., Geneva, Ithaca and Perry, N. Y., Albert Lea, Minn., Trinidad, N. M., New Bedford and Fall River, Mass.

The new Automatic Electric Company will begin business with an order from the Illinois Telephone & Telegraph Company for a switchboard and its appliances and devices for 25,000 telephones.

TELEGRAPHING AND TELEPHONING SIMULTANEOUSLY.

The Northern Pacific Railroad telegraph superintendent, Mr. C. H. Grant, has perfected an invention for the simultaneous transmission of telephone and telegraph messages over the same wire. Tests made over a line 25 miles in length demonstrate that it is a success. It permits of the sending of the ordinary telegraphic message while at the same time two parties are conversing over the line by telephone, there being no confusion of the two systems. Mr. Grant uses an original system of induction coils in condensers. When both wires are being used there is no noise of the clicking of the telegraph instrument noticeable when parties are telephoning. The Northern Pacific will adopt the double system, connecting it with its trans-continental telephone system and telegraph line. The company has ready for service about 115 miles of line, which will be connected in a short time, and the balance of the line between St. Paul and the coast will be finished as fast as the telephone devices can be applied. A similar service has been in use over the long-distance telephone lines for several years.

FORGING A TELEPHONE CHAIN.

A "straw" indicative of the comparatively quiet development of telephone plans in and adjacent to the "metropolitan district" was the acquirement by the Telephone, Telegraph & Cable Company of America, of the lines owned and operated by the Montclair & Bloomfield Telephone Company over in Jersey, says the New York Commercial. While the property is not an important one of itself, its purchase is significant as probably disclosing the policy of the Bell's rival in catching up links here and there that may ultimately prove a formidable chain to be used effectively when the new foreshadowed competition becomes acute.

Not so very long ago the Newark Telephone Company and the Hudson Telephone Company were both operating independently, and with a good business and better prospects, in the two most densely populated counties in the state and in the two largest cities; later, their properties and franchises were bought up by interests operating in harmony with the Bell Company, if not actually with Bell money. But the Montclair and Bloomfield lines were left out of the deal at that time—presumably because their acquisition was not deemed essential—but that left a gap which the T., T. & C. people have now seized and may make a good deal of.

For some time prior to the recent organization of the latter corporation, with Charles W. Morse at its head, the Interstate Telephone Company had been in operation in New Jersey, with lines in Trenton and adjacent towns, in several small towns on the Pennsylvania side of the Delaware river, and in Paterson, and latterly it has acquired the local lines in Elizabeth and outlying villages. The Newark Advertiser hints that the Morse company is the "directing force" now in control of the Interstate and engineering its present operations in New Jersey, and it adds that it has good authority for this statement:

"It is possible that application for franchises will be made to the township of Verona, the township and borough of Caldwell and the borough of North Caldwell. An exten-

sion on the one hand to Morristown and on the other hand to New York, is stated positively to be contemplated for the near future. It is also hinted that the corporation cherishes some hope of securing a franchise in this city."

Next to the establishment of competing telephone lines in Jersey City and along the populous water front area to the northward, Newark is the most important point hereabout that the Telephone, Telegraph & Cable Company of America could occupy as a strategic position—in some respects, superior to the big water front city across the North River. Newark has upward of 250,000 population—is in the same class with New Orleans, Minneapolis, Detroit, Louisville, Milwaukee and Washington—and its business and industries are so numerous and diversified and have such close connections with those of New York and Philadelphia, not to mention the numerous and populous cities and towns lying all about it in Essex and Hudson counties, that its telephone business has already attained huge and profitable proportions, and the possibilities of development and expansion in its telephone field are really tremendous. The Newark public would unquestionably welcome telephone competition such as the Morse company could "put up," but the attitude of the present municipal bodies in the matter of granting another franchise is, of course, problematical. Naturally, the Bell people would put up a strong fight for the retention of that strategic point.

Every advocate of lower telephone rates in the "metropolitan district" would be glad to see the battle pitched in Newark at an early day.

TIME INDICATOR FOR TELEPHONES.

An ingenious device which measures the actual time a telephone has been in use, so that the company may charge the subscriber only for the actual service he has had, is the subject of a patent lately granted to Mr. Thomas Baret of Sydney, New South Wales. The idea, of course, is that a subscriber who has but little use for his telephone will not be compelled to pay the same as one whose instrument is in fairly constant use. To this end the lever switch of the telephone is connected with the clock or other mechanism, which shall be inoperative when the telephone is not in use, but as soon as the receiver is lifted from the hook the clockwork shall commence to operate, and will thus register the extent of time that the instrument has been working. The apparatus is so arranged that the up-and-down movement of the lever switch shall wind up the clockwork, and thus the operation will be almost entirely automatic. A dial is provided for indicating the length of time the telephone has been in use.

TELEPHONE IN PORTO RICO.

The United States has inherited a telephone system in Porto Rico from the Spanish government, and General Greely, the chief signal officer, who superintended the reconstruction of these lines, favors a continuance of the policy pursued by the Spanish government. If his plan is adopted the United States will not only own a valuable telegraph plant but a telephone system which will cover almost the entire island. Under the Spanish system concessions for telephone lines were granted to the highest bidder at a public auction, the bidding being on the percentage the government received from the total collection, the minimum of which was 6 per cent of the collections. Concessions are granted for a period of twenty years, counted from the date of the drafting of the instrument containing the contract. On the expiration of the period of concession the telephone lines and apparatus become the property of the government, which is not required to pay the concessioners anything for it. The concessioners are required to install the most perfect apparatus known at the time the service is inaugurated. If there are any inventions which in the judgment of the government may be of benefit to the telephone service the concessioner is required to make use of it within the period of six months, and should he not do so the government is authorized to establish a new service, making use of the improvements which the new invention might furnish. In addition to this the Spanish government fixed the rate charged for telephones, the maximum charge being $102 for each station. Gen. Greely, who has turned this telephone system over to the insular government, believes future telephone concessions granted for Porto Rico by the United States should be under the same rules that were in force during the Spanish occupancy.

NORTHWESTERN CEDARMAN'S CONVENTION.

The annual meeting of the Northwestern Cedarmen's Association was held at Menominee, Mich., on January 7, as this publication was going to press. We will publish a complete account of the proceedings in the February TELEPHONY.

TELEPHONIC GESTURES.

In the course of the English telephone investigation, it was stated that at Glasgow, when people got angry because the line was busy, they threw the instruments around, injuring them. With regard to similar practices in Cuba, the Philadelphia North American says: In Cuba and the South to-day the receivers of most telephones are attached to the wall in such a way that they are moved up and down in a slot to the height of the ear of the person who wishes to speak. An American sent to Havana to take charge of the telephone service is the inventor of the method. Soon after his arrival he found that charges for repairing receivers was a large item of expense, and he investigated. He found that his customers soon after they began speaking would begin to gesticulate with both hands. The hand that held the receiver generally accented its gesture by jamming the thing into the wall. It was soon out of order. Now that both receiver and transmitter are worked without hands the expenses are much less, besides which the customer has free use of his hands.

A NOVEL TELEPHONE SYSTEM.

J. D. Hobbs and J. D. Peachey are installing a novel telephone system in East Orange, N. J. Their idea is to make a one-sided telephone service take the place of messenger call boxes as well as police and fire alarm calls. They have a small central station. The name of the new instrument is orderphone and it is used only for outgoing calls. Fifty cents a month is paid by the subscriber for the privilege of calling central to order from the butcher, grocer, coal dealer or other tradesman, and at the same time the instrument can be used as a police or fire call in the daytime and as an automatic burglar alarm and thermostatic fire alarm at night. In construction the telephone is simple. The receiver is removed from the hook, which rises slowly, retarded by a pneumatic valve, and rings its own number in central office by means of contact points, which the hook engages. The call is mechanically recorded at central office and answered by an operator, who at once transmits the order either by telephone or messenger.

FROM OCEAN TO OCEAN BY TELEPHONE

A recent dispatch from Helena, Mont., says it is stated that an agreement has been reached between the Rocky Mountain Telephone Company and the Northwestern Telephone Exchange Company, whereby the former will build a line at once from its present eastern terminus at Billings to Miles City, Mont., while the Northwestern Company will build west from its North Dakota terminus to Miles City, thus forming a possible circuit (via New York, Chicago, the Twin Cities, Helena and Portland) from Boston to San Francisco and Los Angeles.